Software for Architecture,
Engineering and Construction

CYPETHERM LOADS

Practical Example

Thermal load calculation of buildings according to the Radiant Time Series Method (RTSM), proposed by ASHRAE.

Contents

The CYPETHERM LOADS programme allows the calculation of thermal loads in buildings and is integrated into the Open BIM workflow. It allows the import and synchronisation of BIM models (IFC4) generated by CAD/BIM programmes. It includes the ASHRAE Weather Data Viewer 6.0 that provides weather data from 8118 stations all over the world.

It has several material databases, including the material database for the Portuguese LNEC (Laboratório Nacional de Engenharia Civil) and those from the EN ISO 10456 code. It incorporates the ISO 6946 and ISO 10077-1 codes for calculating thermal transmission coefficients and the ISO 13370 code for calculating thermal transmission coefficients of elements in contact with the ground.

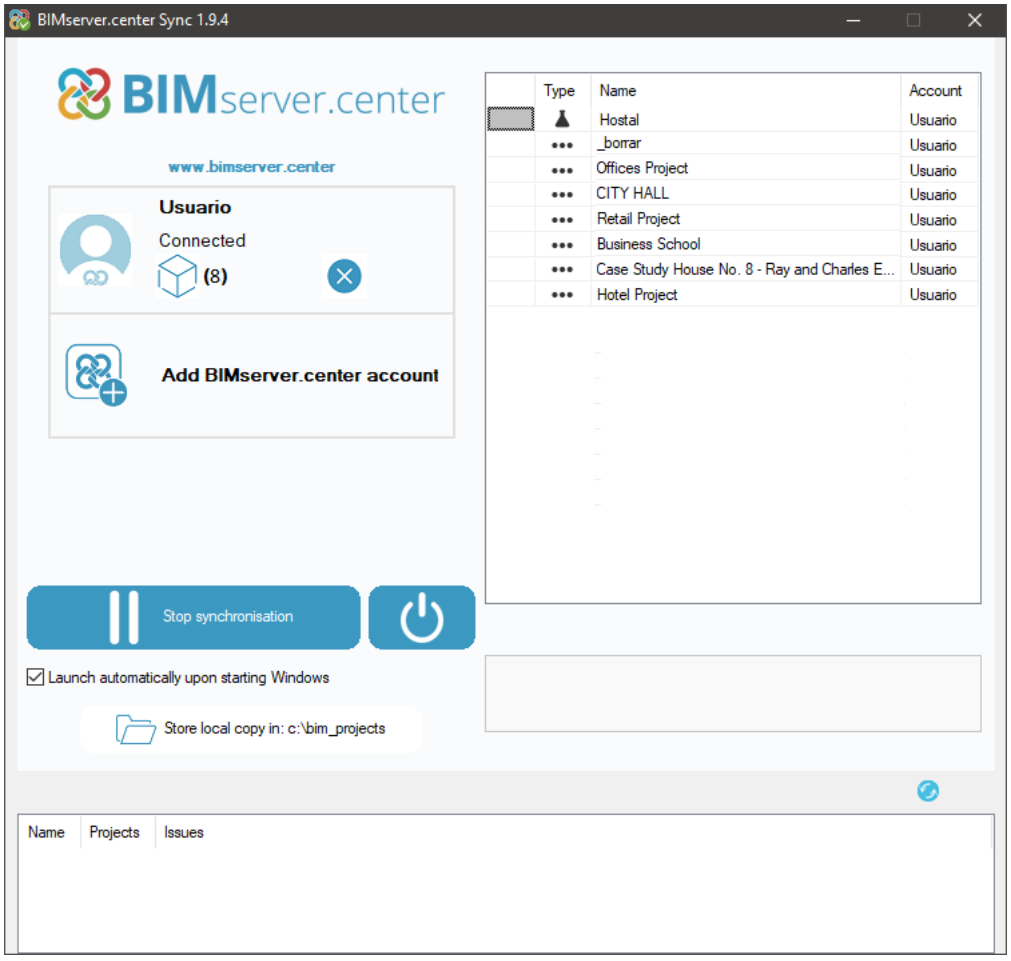
Automatic shading from the IFC file import. It allows edges to be detected in the BIM model and their corresponding linear thermal bridges to be generated automatically, depending on the construction systems chosen and the building description from a thermal calculation point of view (zones, space descriptions, etc.).

Transmission coefficients for linear thermal bridges can be obtained from the ISO 14683 code catalogue or calculated via a finite element calculation in accordance with the ISO 10211 code.

The Radiant Time Series (RTS) method proposed by ASHRAE for calculating heating and cooling loads or the one specified in the EN 12831 code for calculating heating loads can be selected. This document includes a practical example that allows users to put the programme's routine commands and procedures into practice.

1 Project development

Data entry is carried out via linking to a BIM project which has been previously created with a BIM model generation programme or with the free IFC Builder programme.



The following order of data entry is recommended:

1. **Creating the architectural model.**
2. **Creating the thermal load model.** Data is read by importing the BIM model.
3. **Defining the spaces.** With interior design conditions.
4. **Defining the construction systems.** It is useful for users to have libraries, this way, in the IFC file import phase, the **Directory for searching typologies** option can be activated. If the construction systems defined in the BIM model have the same reference as those in the library, they will be defined automatically. If the reference does not exist in the library, the element may be defined by the user, and it can even be

exported to their library so that it becomes part of it and can be used in future projects. All imported elements can be edited.

5. **Edges processing.** Calculating linear thermal transmission coefficients according to the defined configuration.
6. **Defining the calculation model.** Configuring calculation options and climate data.
7. **Building zoning.** Creating various zone hypotheses for the building to be used in the calculation.
8. **Calculation and analysis of results.** After clicking on **Update results**, results can be analysed, and result documents can be obtained and exported to the BIM model.

2 Creating the architectural model

2.1 BIMserver.center

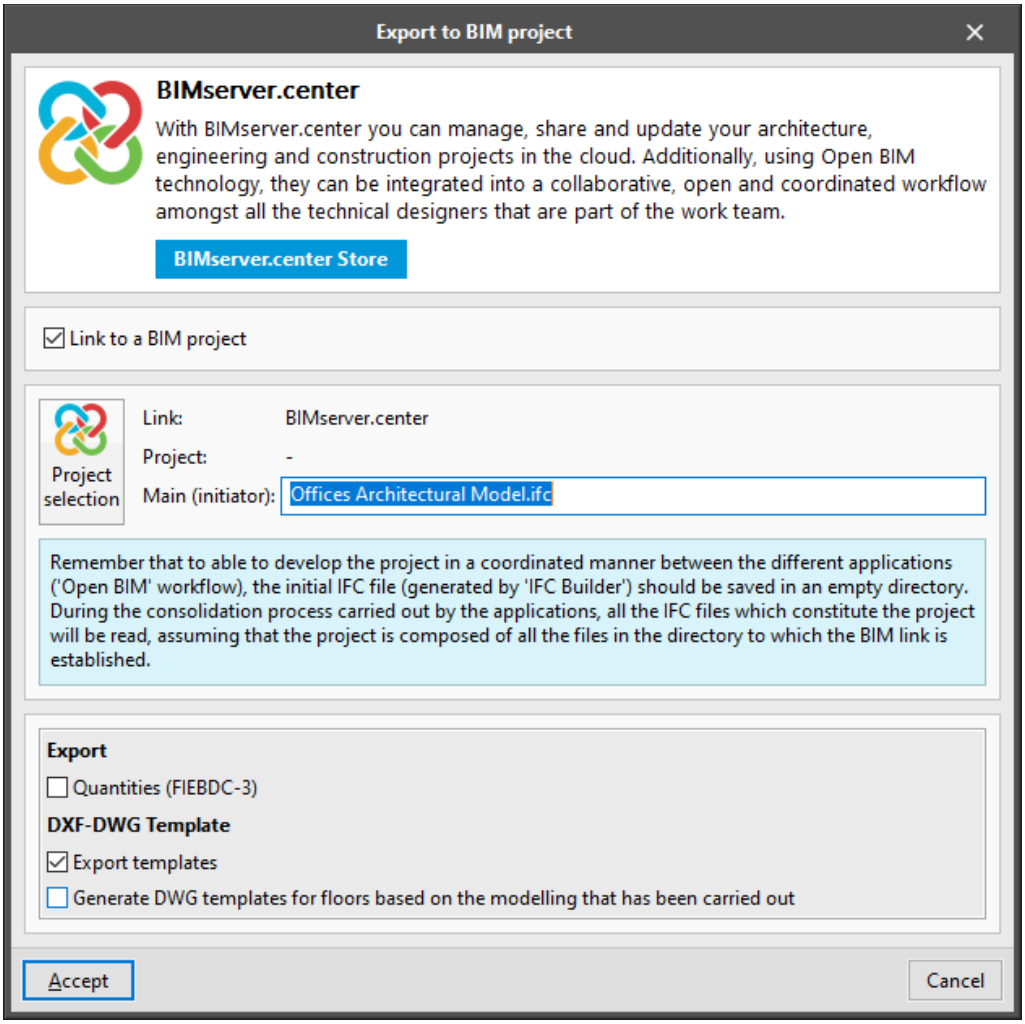
This example uses an architectural BIM model from CYPE's free architectural modelling programme, IFC Builder.

The process of exporting an architectural BIM model by generating an IFC file in BIMserver.center from IFC Builder is explained below. If you have not yet registered on this platform http://bimserver.center/, you must do so in order to log in using an email address and password.

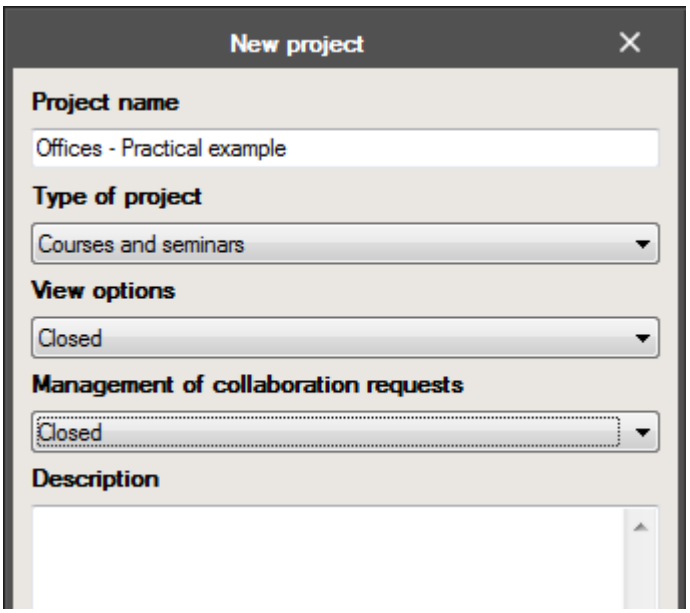
2.2 IFC Builder

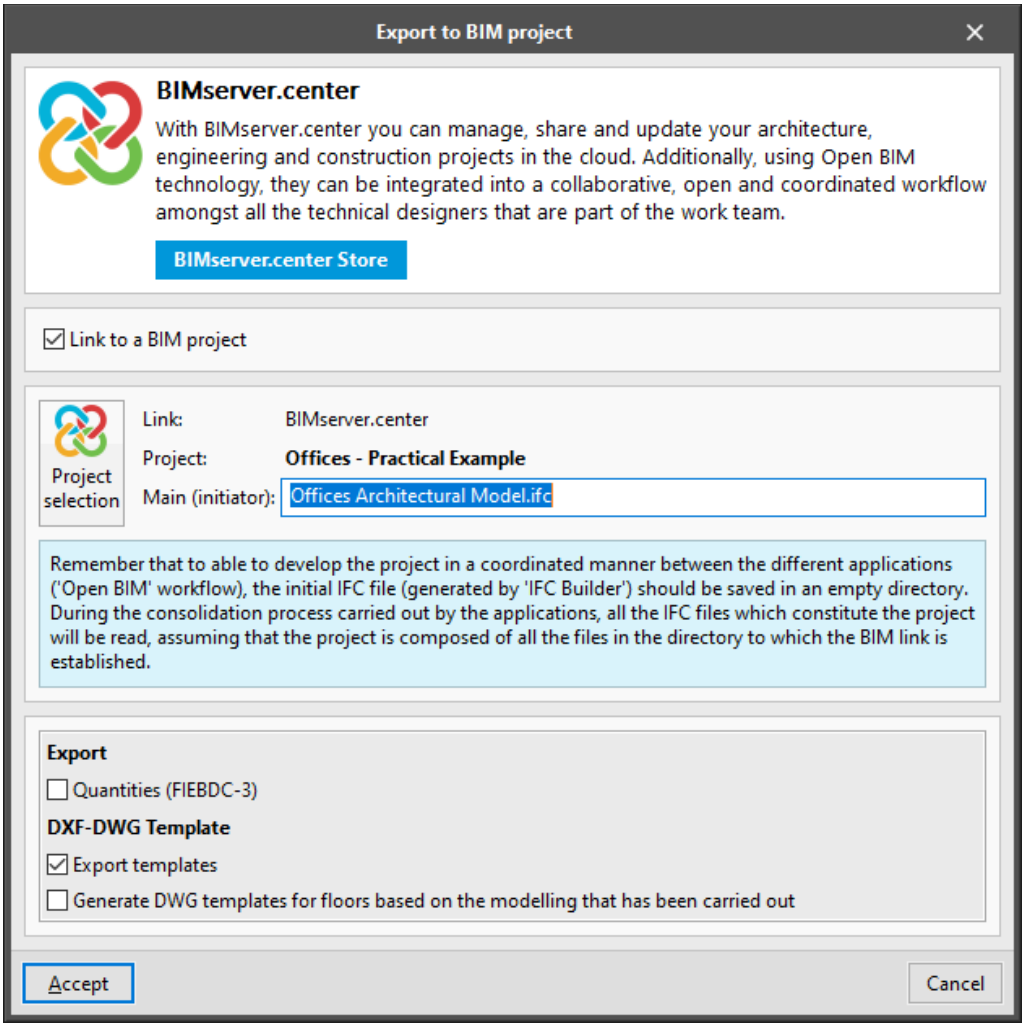
The example starts with the IFC Builder programme.

- Run  IFC Builder.
- Click on the  Examples icon.
- Select the Offices file.
- In the top right corner, click on  **Share** and **Project selection**.



- Fill in the data according to the figure below.





Click on **Create new project**, and set the project name to *"Offices – Practical example"*.

- A new window with exportation information will appear, click **Accept**.
- To confirm whether the project is in BIMserver.center, click on the icon in the Windows taskbar next to the clock and date displayed onscreen.
- If this icon does not appear, click on CYPE's general menu in the Open BIM group and then on **BIMserver.center** to activate it.
- The BIMserver.center platform may also be accessed directly.

2.3 Description of the building

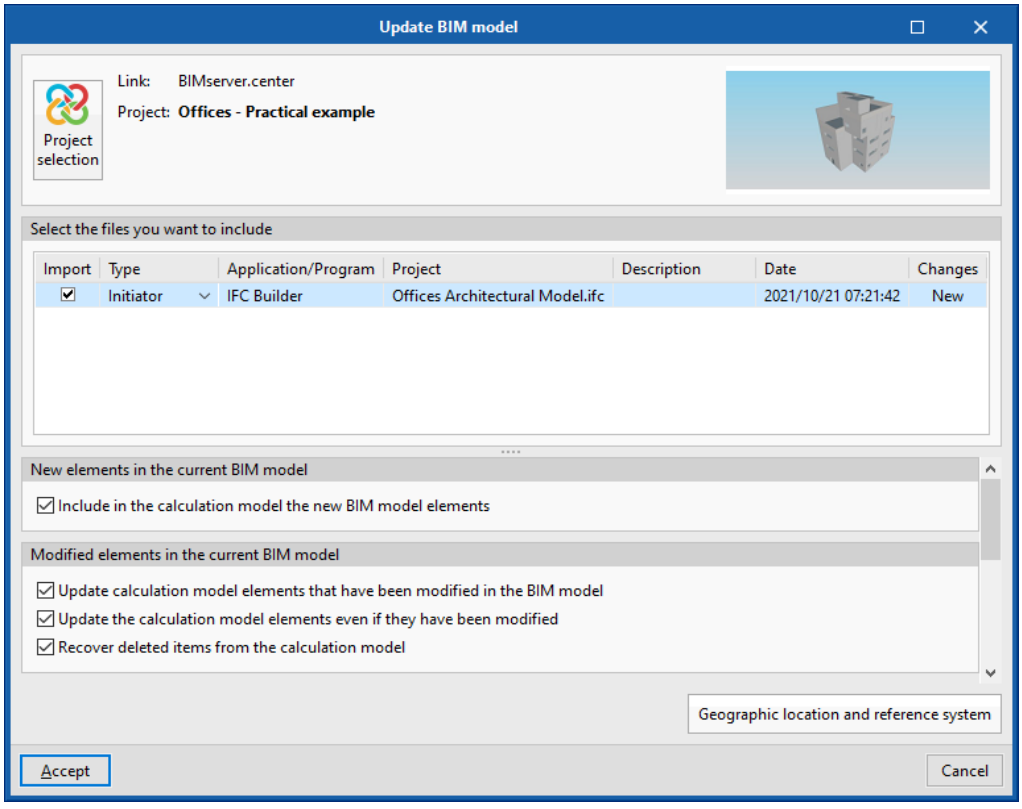
The office building consists of 5 floors. On floor 0 (ground floor) there is a dining room and an office. Floors 1 to 3 consist of offices and meeting rooms. Technical areas (machine room, etc.) are located on floor 4. Floor 5 is the roof.

2.4 Creating the lighting model

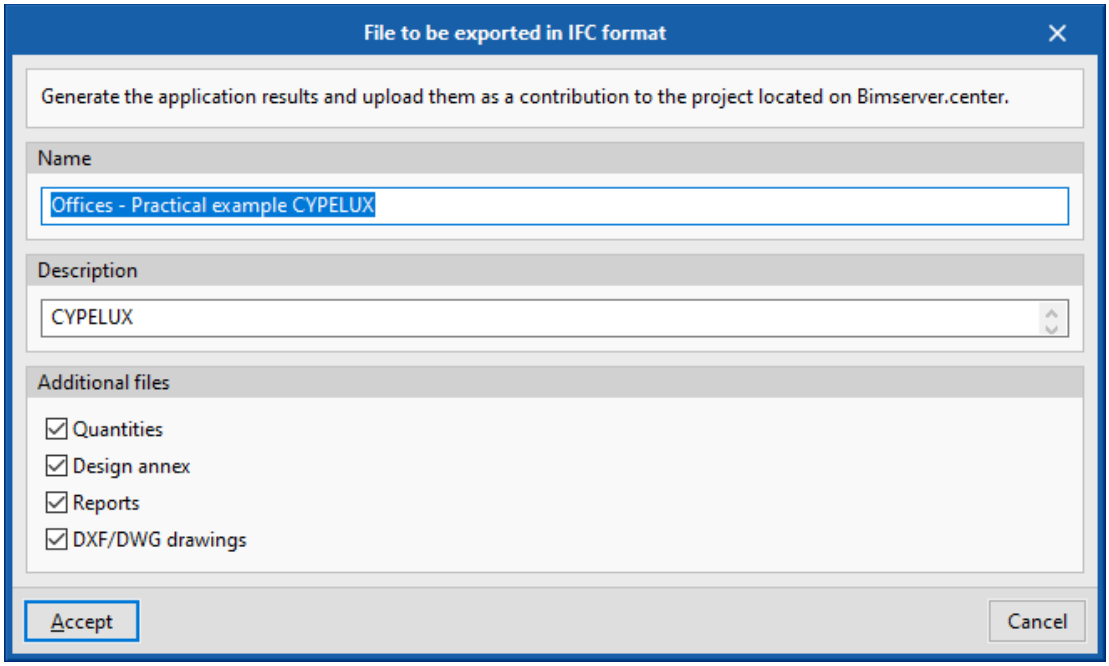
The CYPETHERM LOADS programme allows lighting data to be entered manually, but it also allows the same data from the lighting model created in CYPELUX to be entered automatically.

Start with the CYPELUX programme.

- Run  **CYPELUX**.
- Click on the **Examples** icon and select *Offices*.
- In the top right-hand corner, click on **Update**.
- Click on **Project selection** and select the *Offices - Practical example project*.



- In the top right-hand corner, click on **Share**. The programme will ask whether you wish to update the results before exporting the information. Click on **No**.



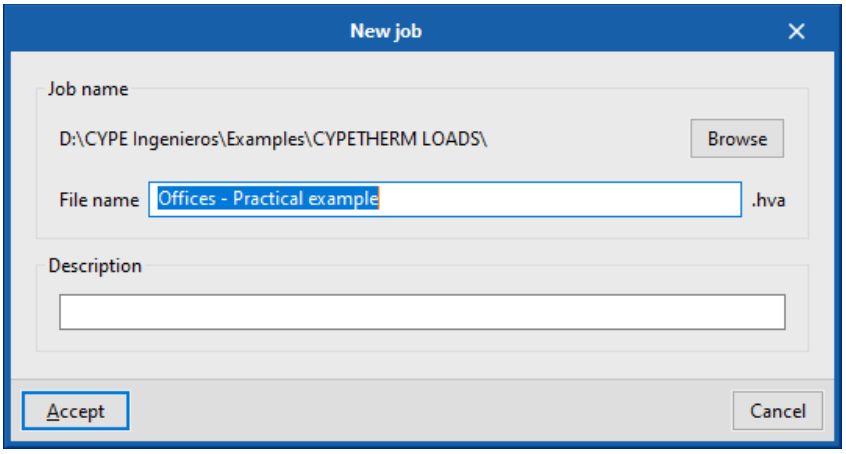
Information with lighting data, light positioning and reports was exported to the *"Offices - Practical example"* BIM project on the BIMserver.center platform.

3 Creating the thermal loads model

3.1 Creating the file

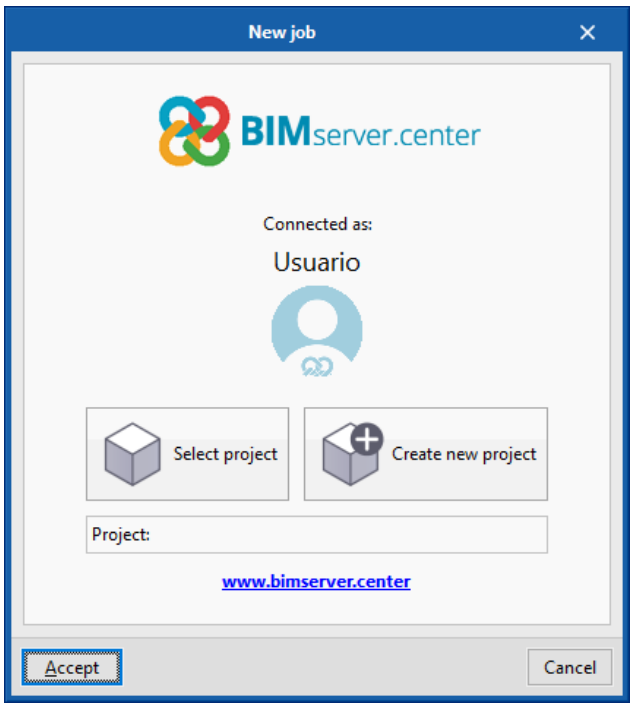
Start the CYPETHERM LOADS programme.

- Run **CYPETHERM LOADS.**
- Click on **File/New**. In the pop-up window, enter a job name.



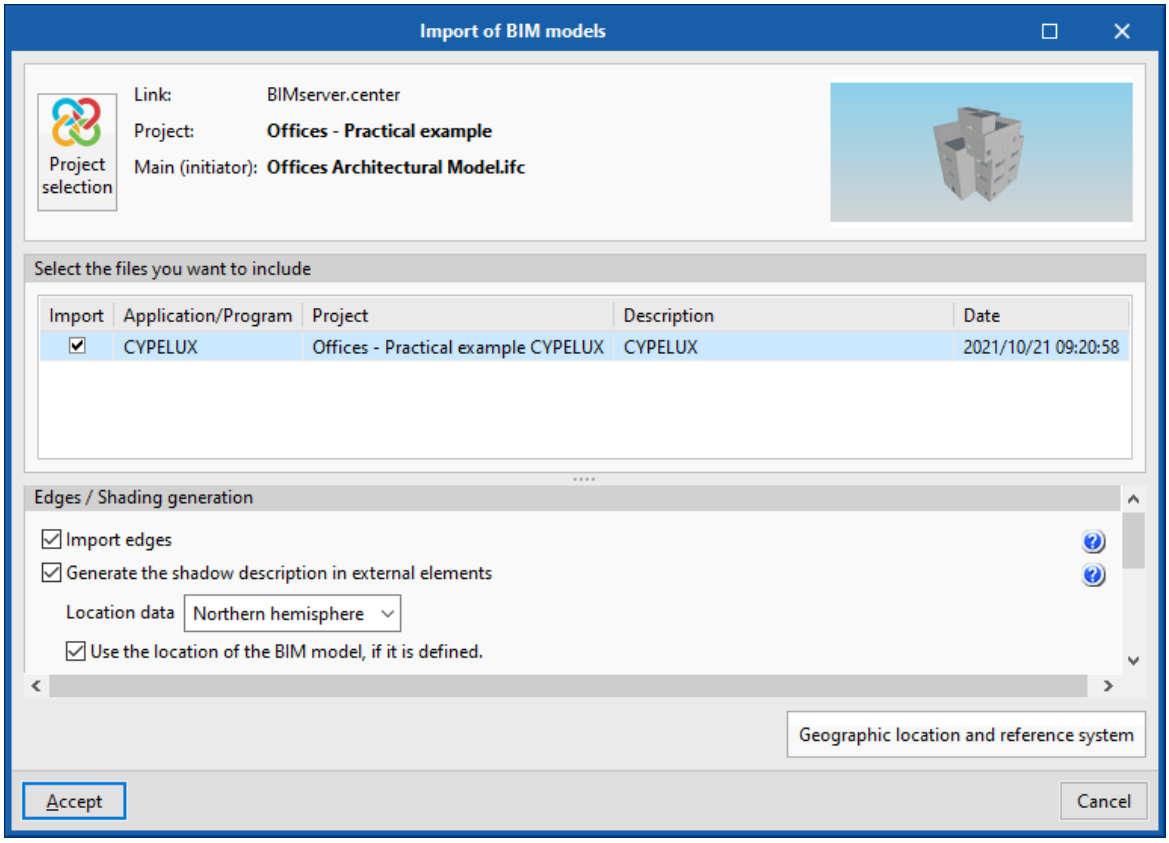
4 Linking to a BIM project

A new window opens, allowing users to either link to an existing BIM project on the BIMserver.center platform or create a new one.



- Click on **Select project**.
- Select the previously created *"Offices - Practical example"* job and click on **Accept**.

The configuration window for importing the BIM template will be displayed.



The **Directory for searching typologies** option allows users to indicate the location of their Library, which they will have developed over time.

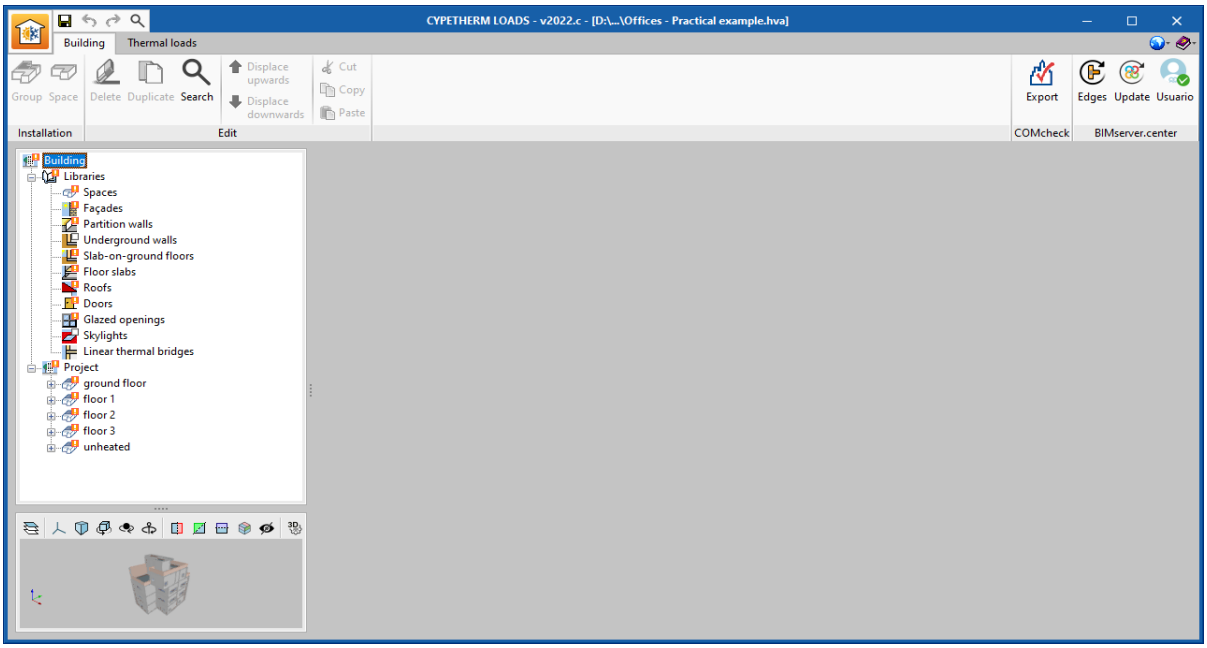
If the construction elements defined in the BIM model have the same reference as those in the library, they will be defined automatically. If the reference does not exist in the library, the element must be defined by the user, who can even export it to their existing library so that it can be added and then used in future projects. All imported elements may be edited.

In this example, the address where the library is located will not be specified, as the intention is to show the manual creation of all the elements. However, during the process of this example, it is shown how to create this user library.

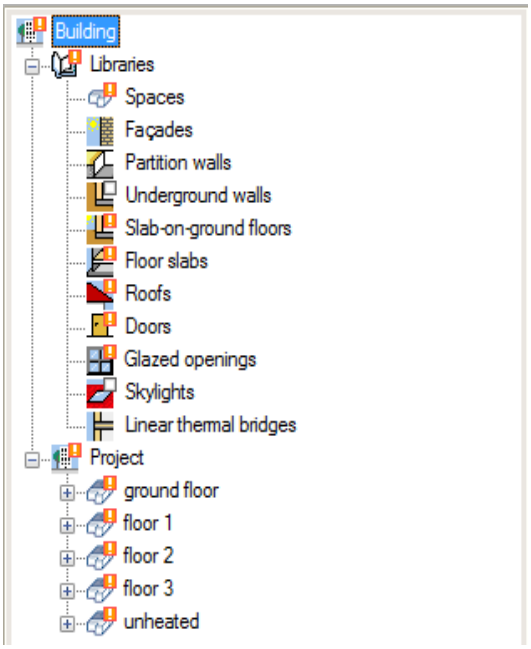
Keep the default options according to the figure above and click **Accept**.

4.1 Building information

Building information (zones, spaces, construction elements) has been imported and can be viewed in tabular form on the left-hand side and underneath in a 3D view.



In the structure, some elements are highlighted with an exclamation mark. This means that some parameters must be defined by the user. If the path for the user library had been indicated during the import process and if these element types had been present, these exclamation marks would not have appeared, just as mentioned above.



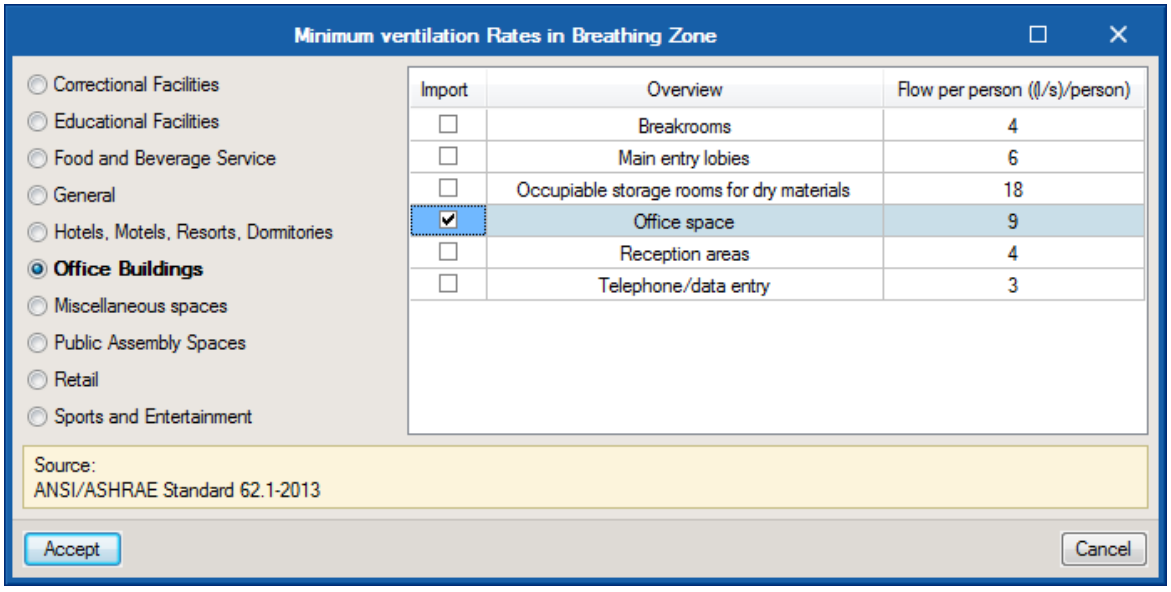
5 Defining spaces

Click on **Spaces**. The space types in the building will appear.

	Reference
1	Office
2	Lift
3	Risers
4	WC
5	Corridor
6	Meeting room
7	Dining
8	Hall
9	Stairs
10	Technical room

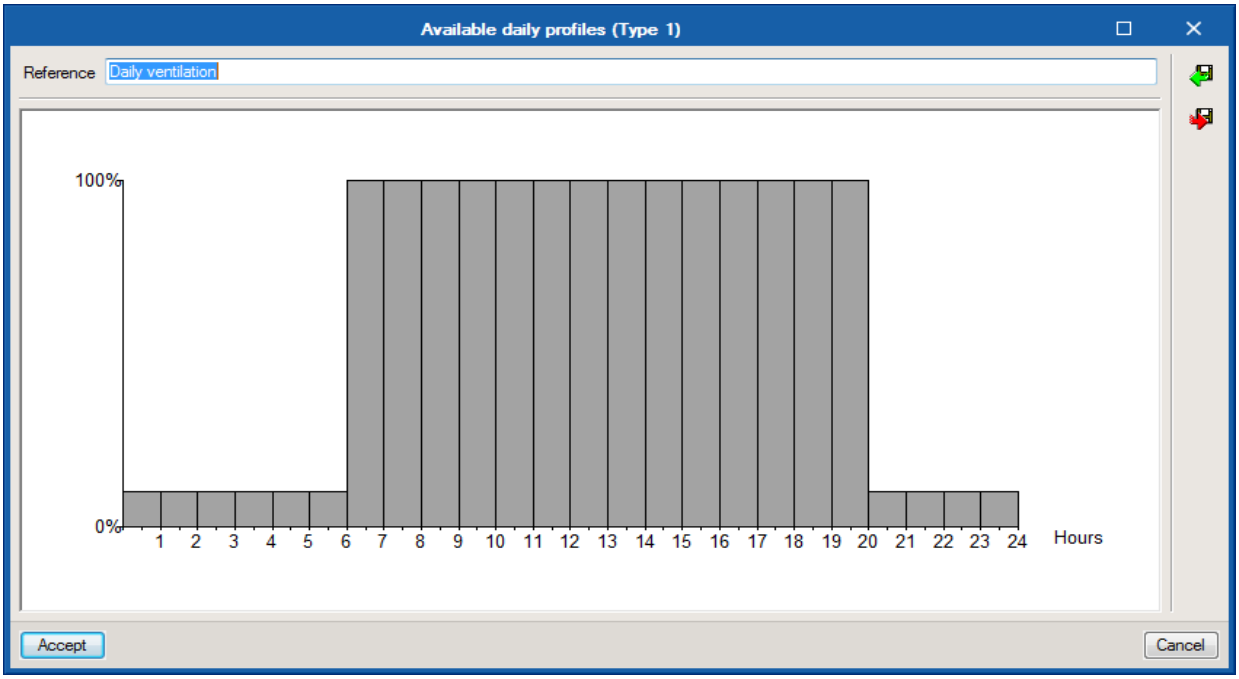
5.1 Office

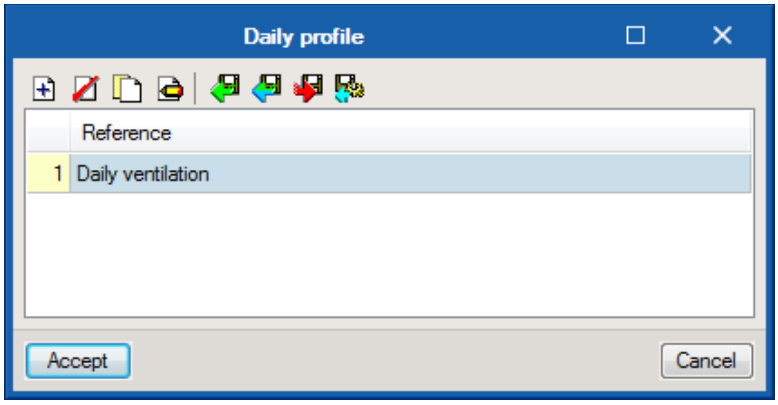
- Click or double click on **Edit**, with the *Office* space type selected.
- Activate the **Ventilation** option.
- Click on , select the **Office Buildings** and **Office space** options.



- Activate the **Schedule** option in the *Ventilation* section**.**

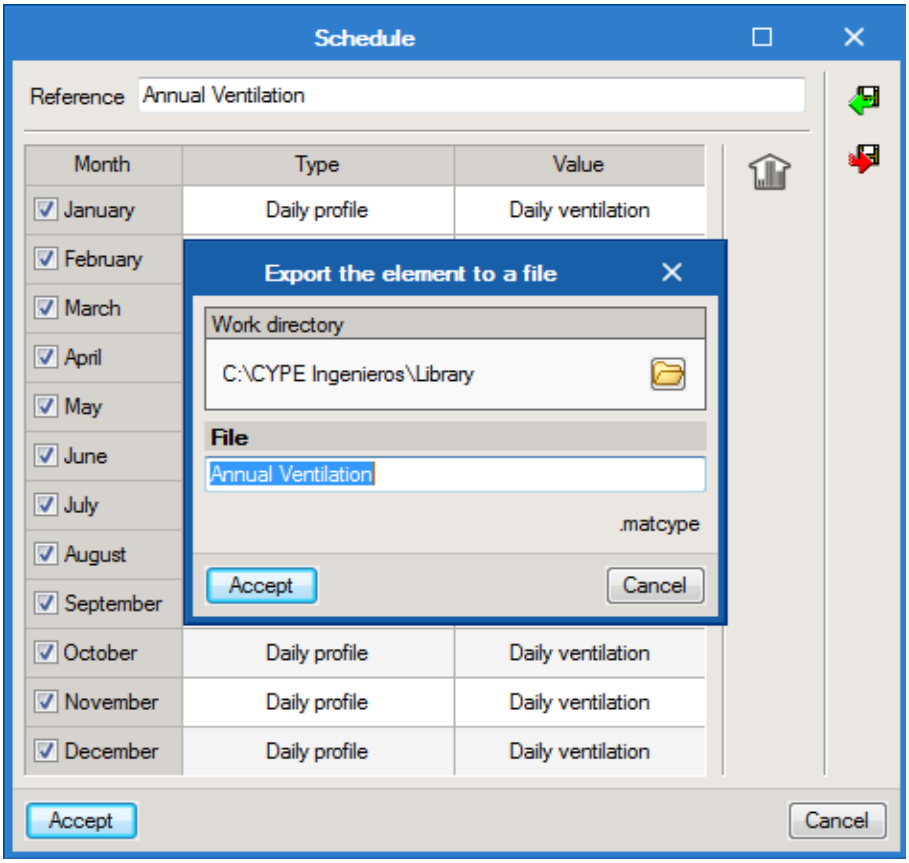
- Click on **Available daily profiles** to create a specific profile.
- Click **Add** a new element to the list.
- Type *"Daily ventilation"* into the **Reference**.
- Position the cursor and click consecutively to create a profile according to the figure below, from 6 to 20 hours ventilation will be 100%, for the remainder of the period, it will be 10%.



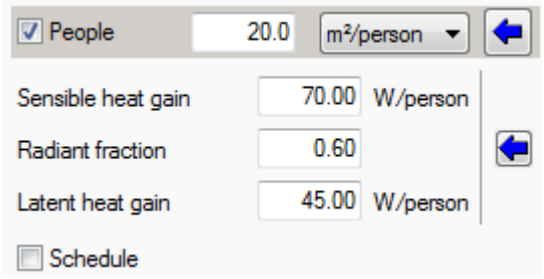


- In the *Type* column, click on **Constant percentage** and select **Daily profile** which, in this case, corresponds to the ventilation profile. The same applies to all months. They can be selected at the same time.
- Click on **Export** to import to other spaces and projects later on.

- Type in the *File* name.

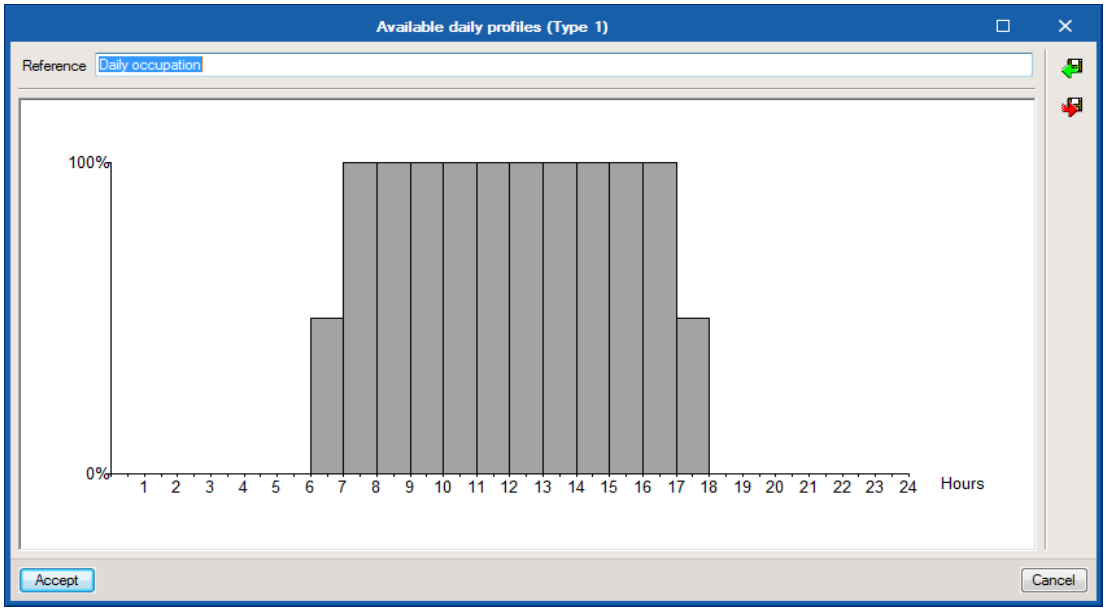


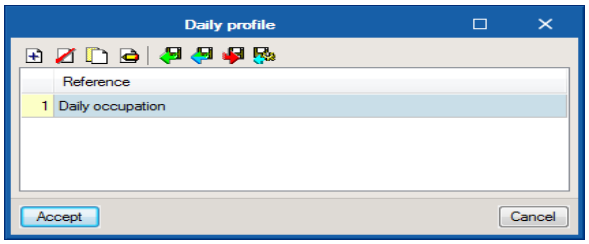
- Returning to the *Space* window, activate the **Internal heat gains** option and then **People**.
- Click on **People**, select the **Office Buildings** and **Office space** options.



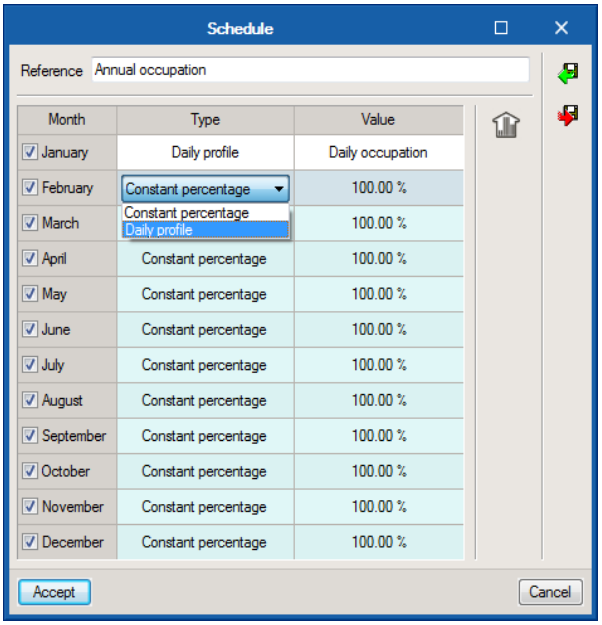
- Keep the remaining default options.
- Activate the **Schedule** option, related to the *People*.
- Click on **Add** to add a new element to the list and type in a *Reference* name.

- Position the cursor and click consecutively to create a profile according to the following figure.

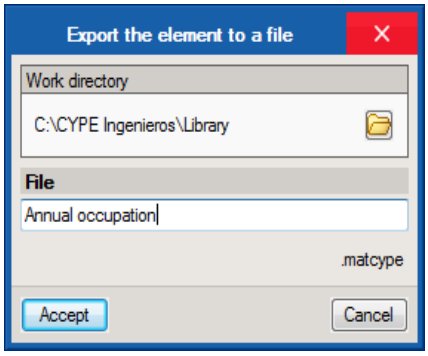




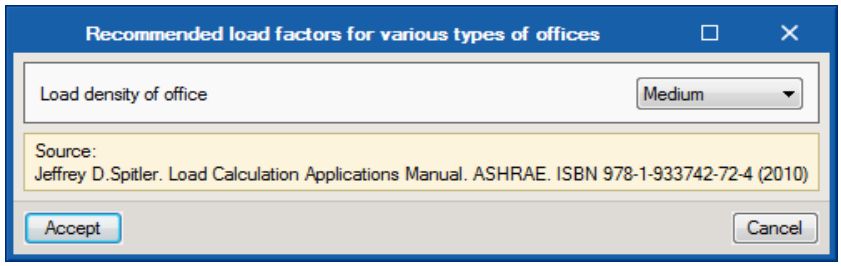
In the *Type* column, click on **Constant percentage** and select *Daily profile***.** The same applies to all months.

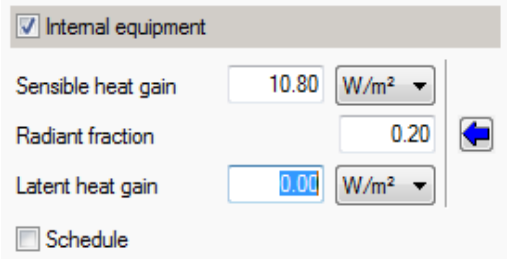


- Click on **Export** to import into other spaces or other jobs later on.
- Type in a *File* name and double-click **Accept**.

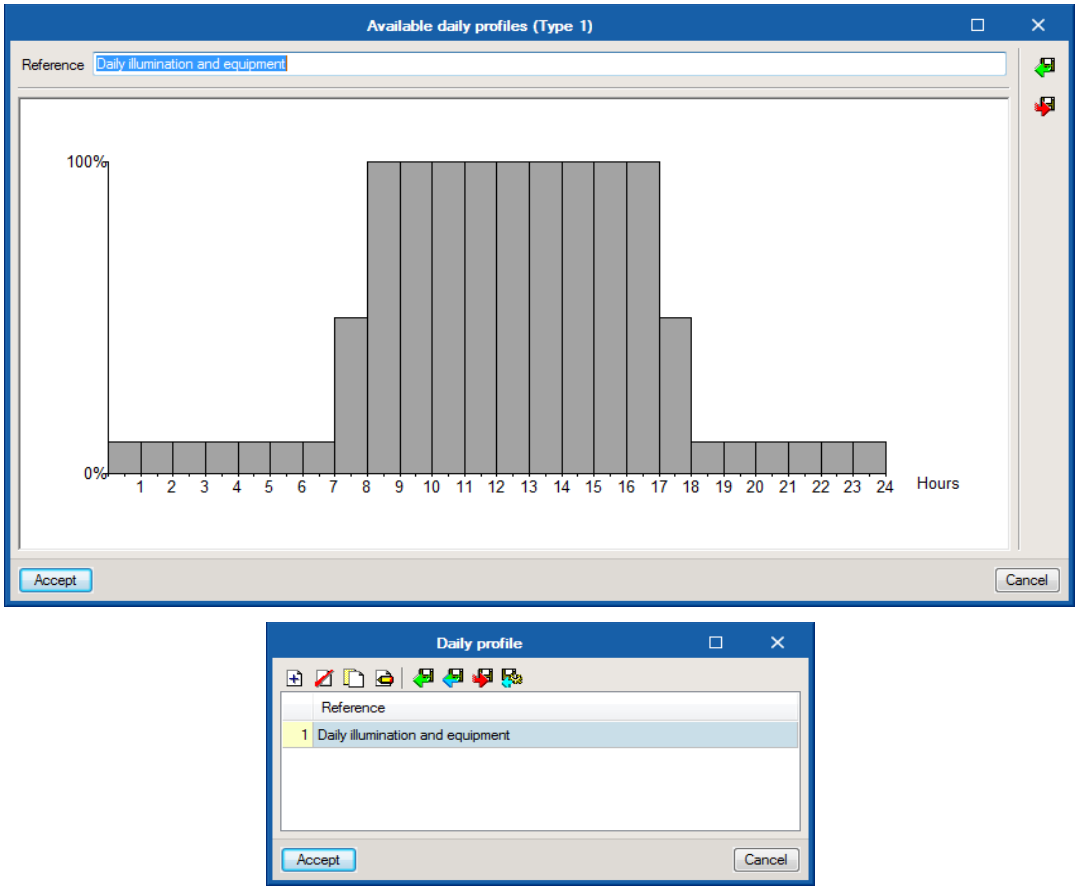


- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on **Internal equipment** and select the **Medium** option.

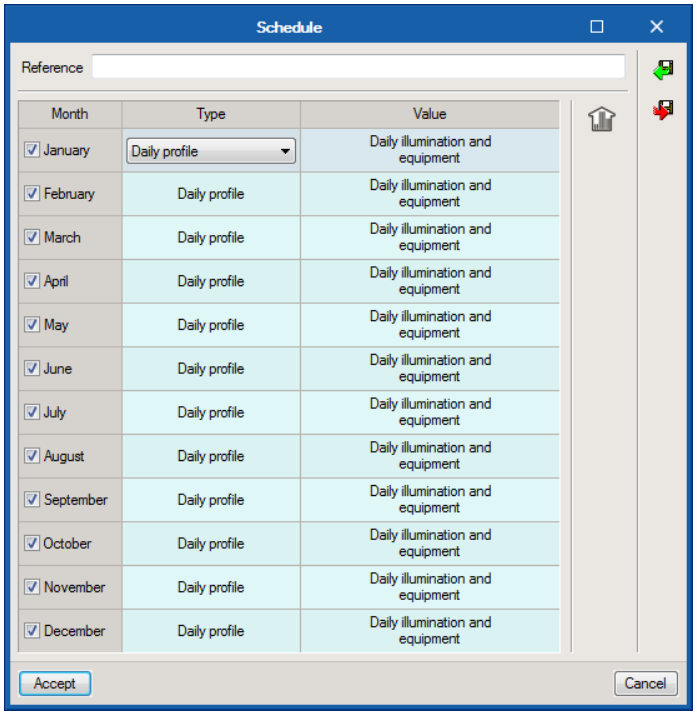




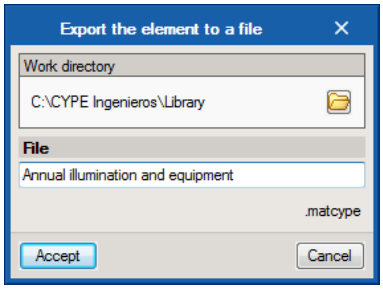
- Activate the **Schedule** option, related to the **Internal equipment**.
- Click on **Available daily profiles** to create a new profile.
- Click on **Add** to add a new element to the list and type in a *Reference* name.
- Position the cursor and click consecutively to create a profile according to the figure below, from 18 to 7 hours, lighting and equipment will be at 10%; from 7 to 8, and from 17 to 18 hours, lighting and equipment will be at 50%; and from 8 to 17 hours, it will be at 100%.



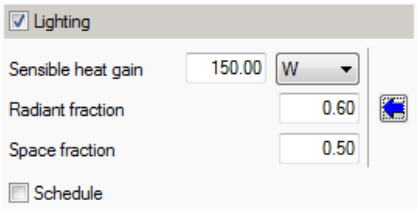
- In the *Type* column, click on **Constant percentage** and select *Daily profile* which, in this case, corresponds to the ventilation profile. The same applies to all months.

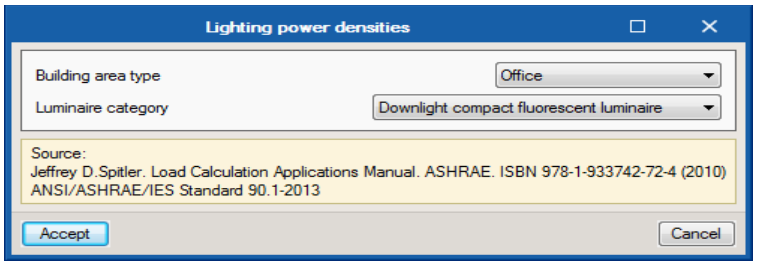


- Click on **Export** to import to other projects later on.
- Type in the *File* name *"Annual illumination and equipment"*.

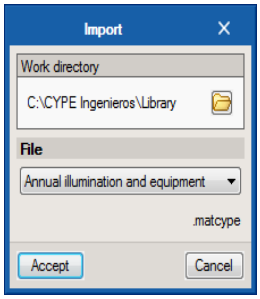


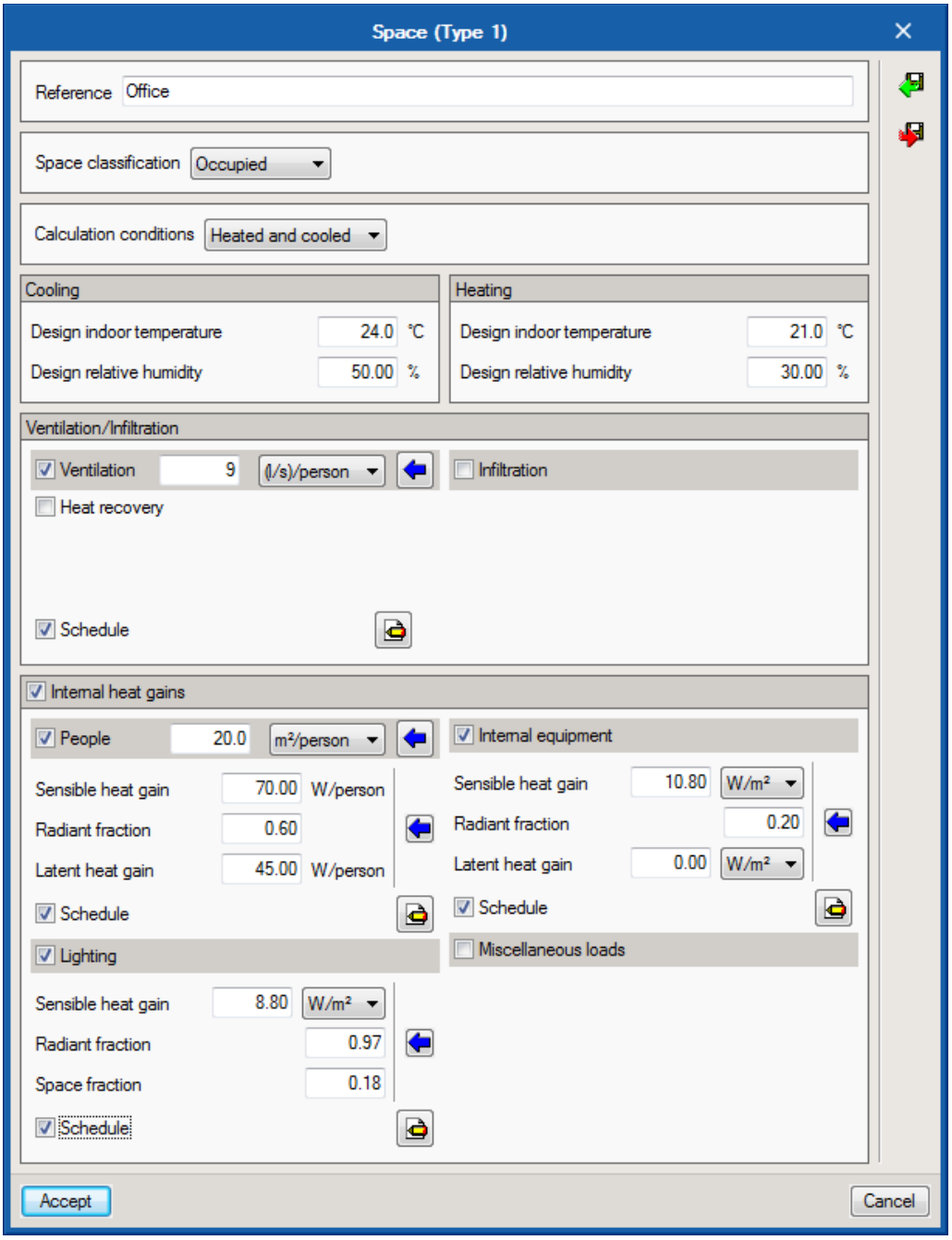
- Returning to the *Space* window, activate the **Lighting** option.
- Click on **Lighting**, select the **Office** and **Downlight compact fluorescent luminaire** options.





- Activate the **Schedule** option.
- As this profile is the same as the profile defined earlier for the internal equipment, click on **Import**.
- Select the *Internal equipment* profile and click on **Accept**.





Next, users will want to export the *Offices* space type to their library. This will allow them, in this example, to import their features to other space types. On the other hand, it means that data will not have to be redefined in future projects.

- Click on **Export**, type in the name *"Office"* and click **Accept**.

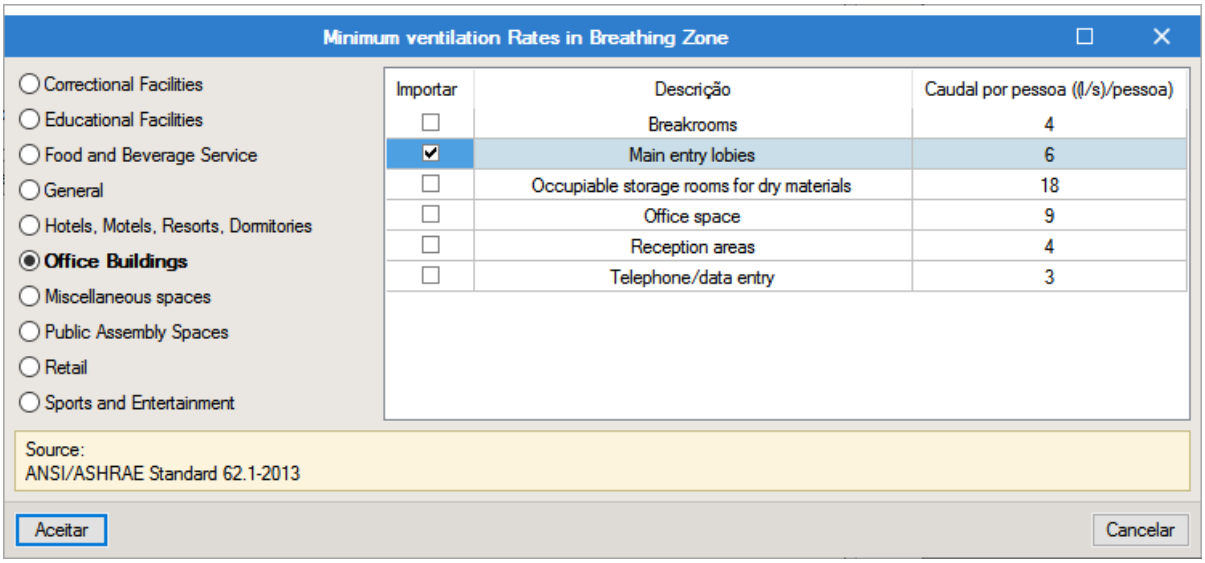
5.2 Meeting room

As this space type has the same features as the **Offices** type, the **Offices** type is imported from the library and then renamed “Meeting Room”.

- Select the space for the meeting room and click on **Edit**.
- Click on **Import**, select **Offices** and click on **Accept**.
- Change the **Reference** to “Meeting room” and click on **Accept**.
- The **Occupant density** will be higher, so enter 5 m²/person.
- Click on **Export** this new space type for use in future projects.

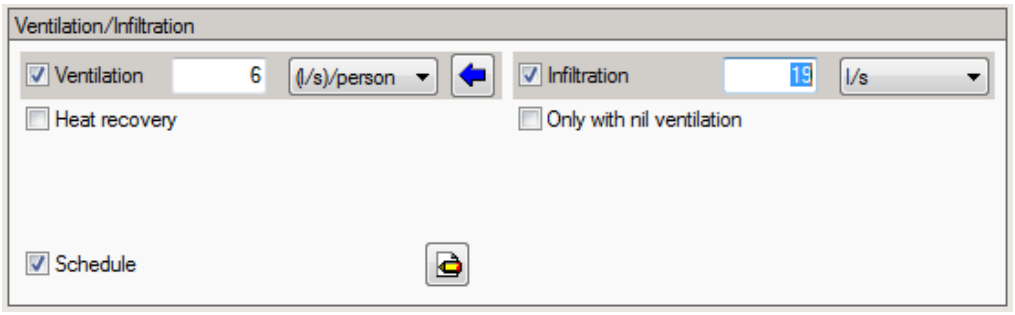
5.3 Corridor

- Double click (or click on **Edit**) for the *Corridor* space type.
- Activate the **Ventilation** option.
- Click on and select the **Office Buildings** and **Main entry lobbies** options.

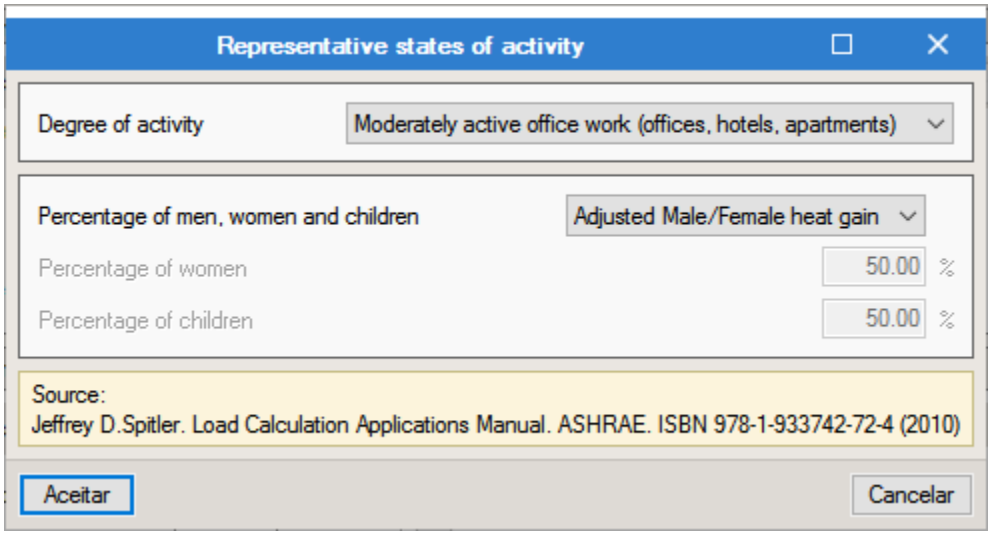


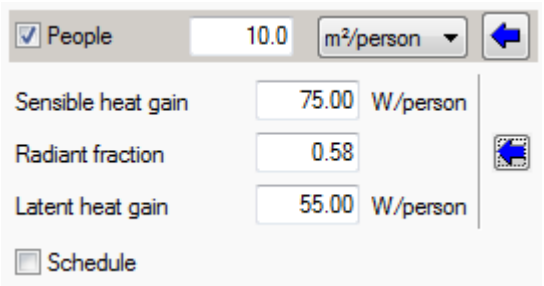
- Activate the *Schedule* option in the **Ventilation** section.

- Click on **Import** and select the *Ventilation* profile from the library. Click **Accept**.
- Returning to the *Space* window, activate the **Infiltration** option, type in 19 l/s.



- Activate the **Internal heat gains/People** option.
- Click on , select the **Office Buildings** and **Main entry lobbies** options and click **Accept**.
- Click on in **Heat gains**, select the **Moderately active office work (offices, hotels, apartments)** option.

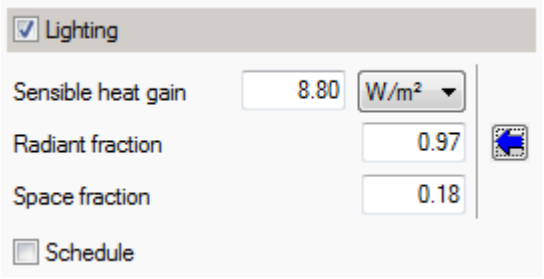




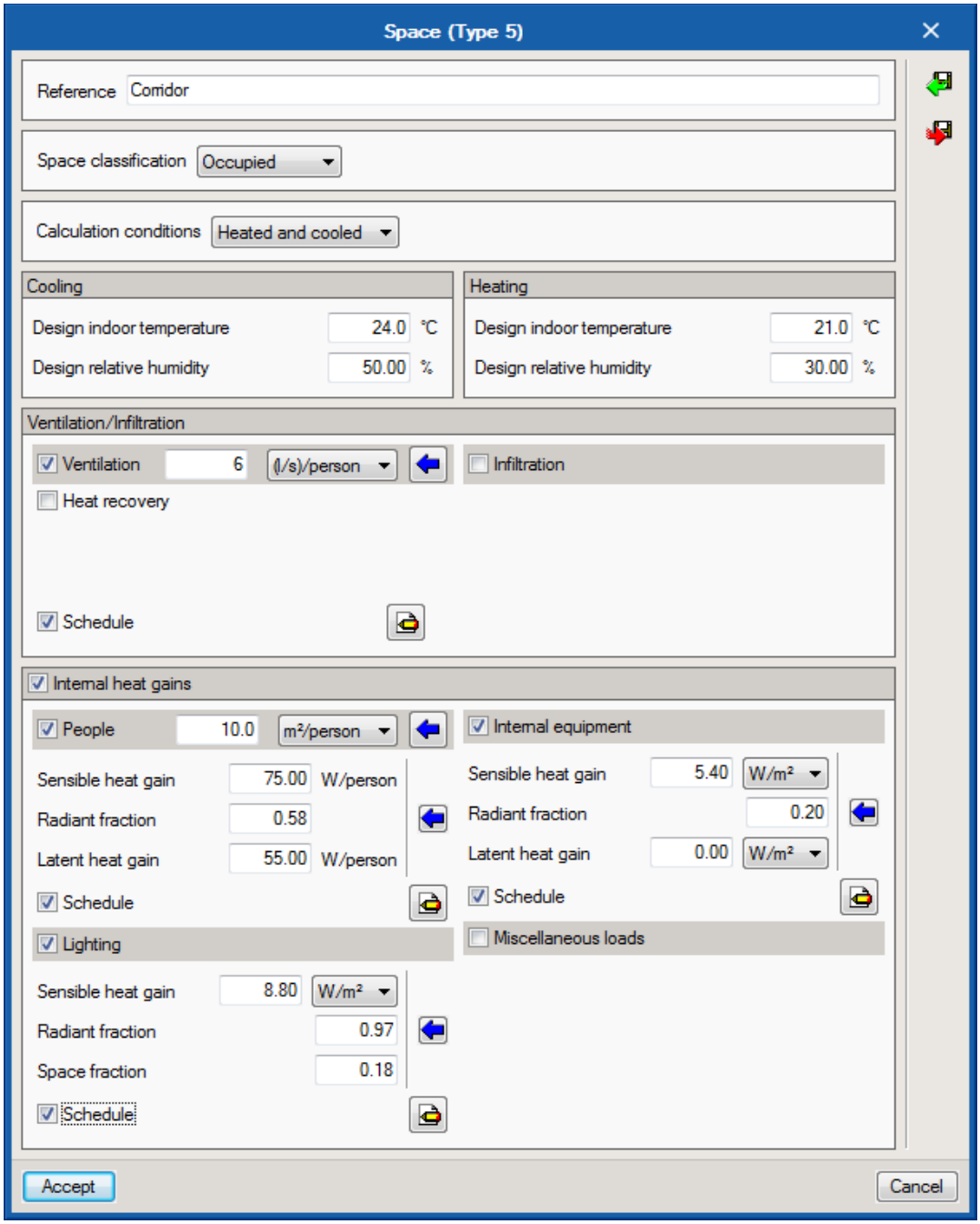
- Activate the **Schedule** option for *People*.

- Click on **Import** and select the *People* profile from the library.
- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on in **Internal equipment**, select the **Light** option.

- Activate the **Schedule** option for the **Internal equipment**.
- Click on **Import** and select the *Internal equipment* profile from the library.
- Returning to the *Space* window, activate the **Lighting** option.
- Click on in **Lighting**, select the **Office** and **Downlight compact fluorescent luminaire** options.



- Activate the **Schedule** option for **Lighting**.
- Click on **Import** and select the *Lighting* profile from the library.



- Next, users will want to export the *Corridor* space type to their library. This will allow, in this example, their features to be imported to other space types. On the other hand, it means that data will not have to be redefined in future jobs.

- Click on **Export**, type in the name *Corridor* and click **Accept**.

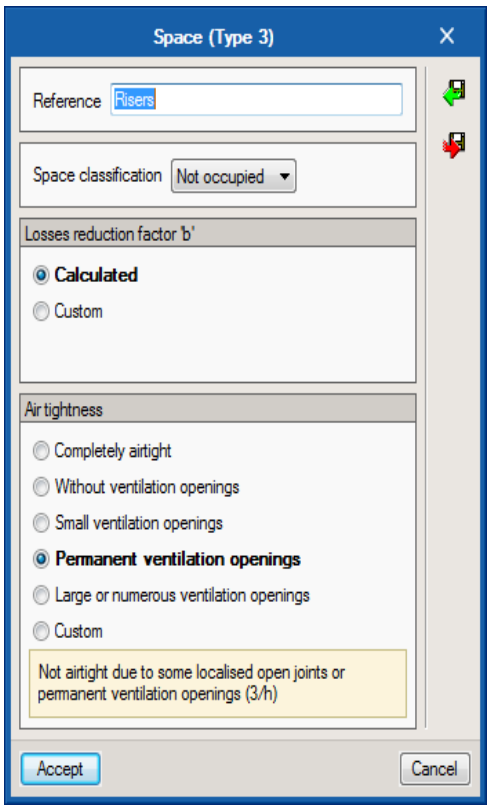
5.4 Hall

As it shares the same features as the *Corridor* space type, the aim is to import the **Corridor** type from the library and then change its name.

- Double click or select the *Hall* space type and click on **Edit**.
- Click on **Import**, select *Corridor* and click on **Accept**.
- Change the reference to *Hall* and click on **Accept**.

5.5 Risers

- Classify the space as *Non-habitable*.
- Type in the data according to the figure below.



5.6 Stairs

- Follow the same procedure as for *Risers*.

5.7 Lift

- Follow the same procedure as for *Risers*.

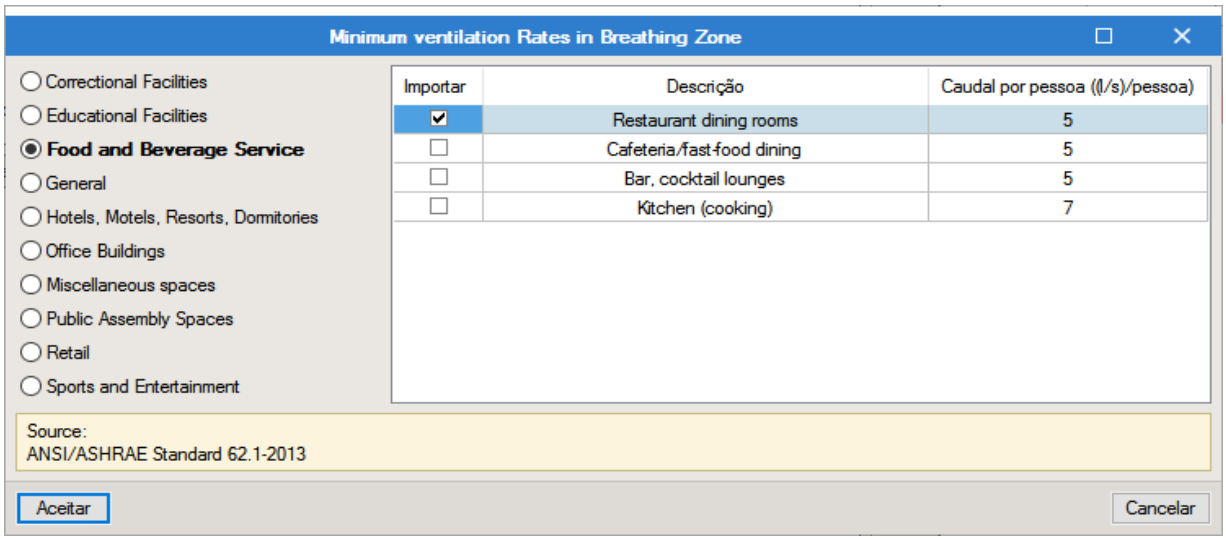
5.8 WC

- Follow the same procedure as for *Risers*.

5.9 Dining

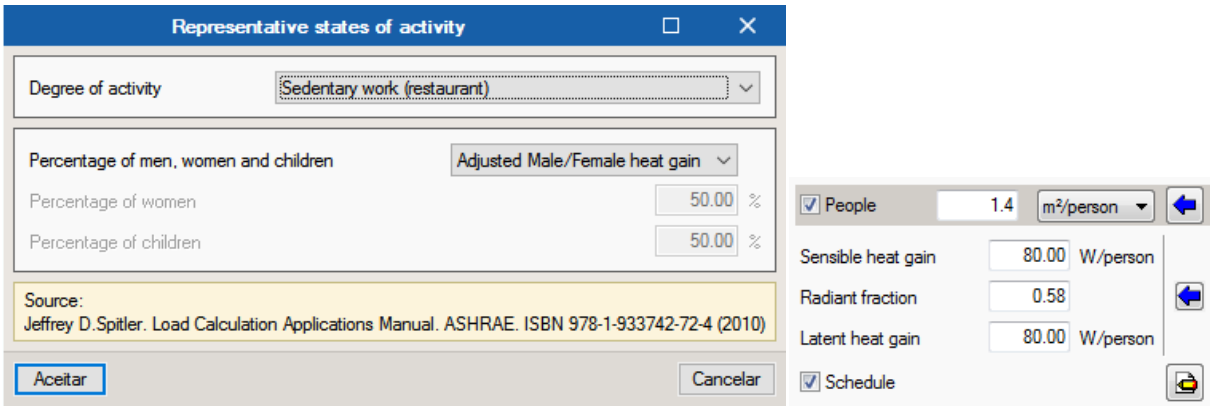
As it shares the same features as the *Corridor* space type, the aim is to import the *Corridor* type from the library and then change its name.

- Select the *Dining* space type and click on **Edit**.
- Activate the **Ventilation** option.
- Click on , select the **Food and Beverage Service** and **Restaurant dining rooms** options.

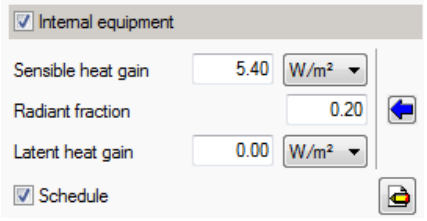


- Activate the **Schedule** option in *Ventilation*.
- Click on **Import** and select the *Ventilation* profile from the library. Double-click **Accept**.
- Returning to the *Space* window, activate the **Internal heat gains** option.
- Activate the **People** option.

- Click on **People**, select the **Food and Beverage Service** and **Restaurant dining rooms** options.
- Click on the **Heat gains** in *People*, select the **Sedentary work (restaurant)** option.

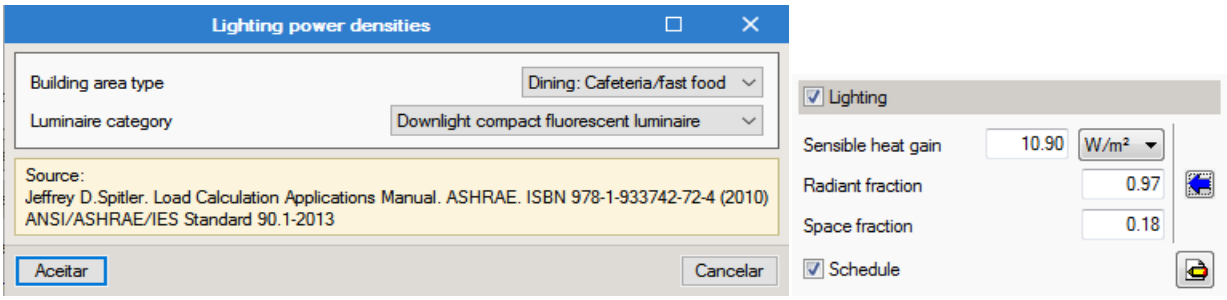


- Activate the **Schedule** option for the *People*.
- Click on  **Import** and select the *People* profile from the library. Double-click **Accept**.
- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on  in **Internal equipment**, select the **Light** option.



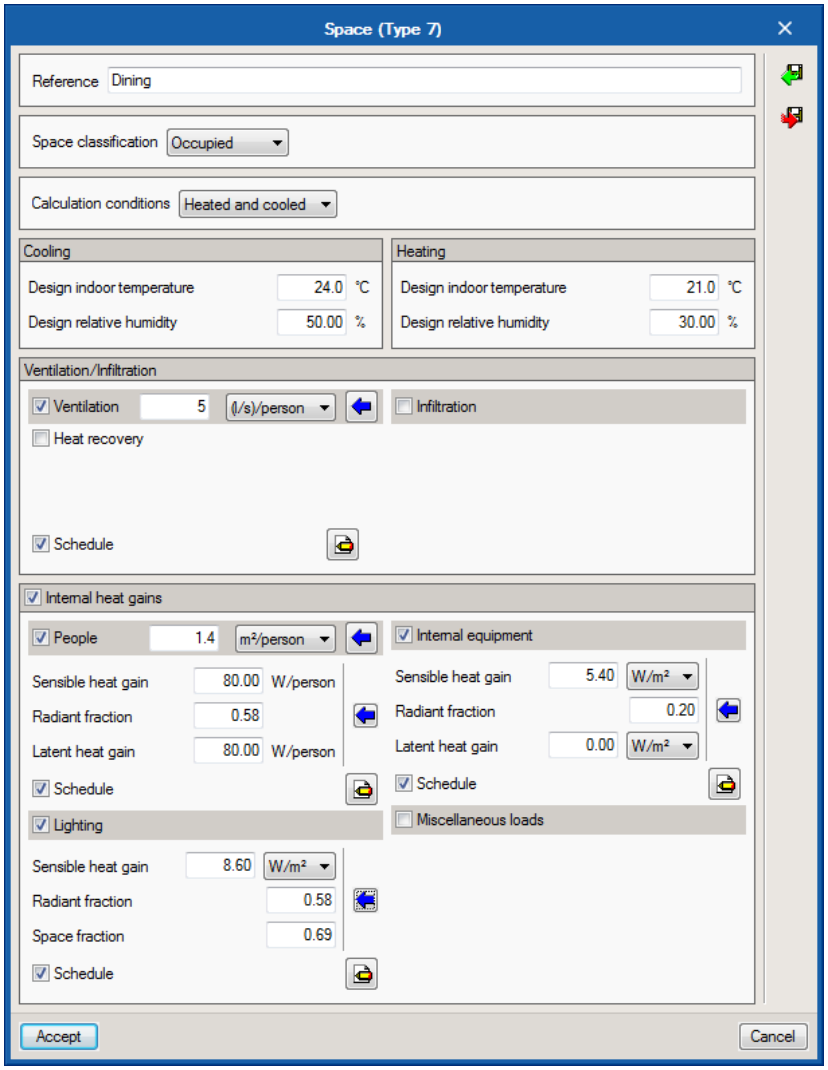
- Activate the **Schedule** option for the *Internal equipment*.
- Click on  **Import** and select the *Internal equipment* profile from the library. Double-click **Accept**.
- Returning to the *Space* window, activate the **Lighting** option.

- Click on in **Lighting**, select the **Dining: Cafeteria/fast food** option and **Downlight compact fluorescent luminaire**.



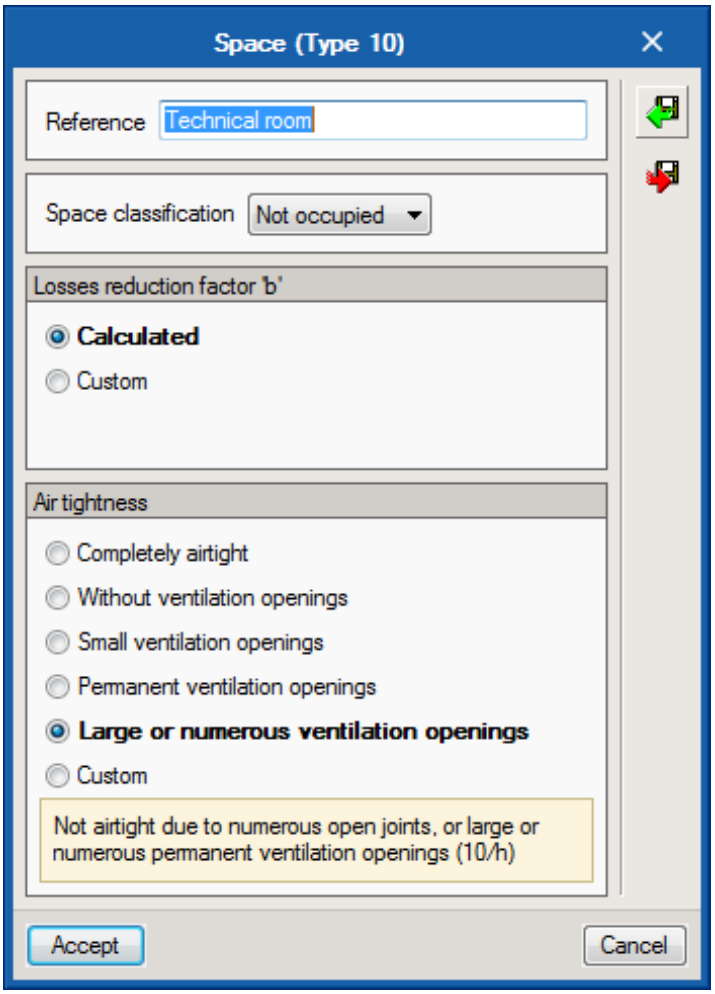
- Activate the *Schedule* for the *Lighting*.

- Click on **Import** and select the *Lighting* profile from the library. Double-click **Accept.**

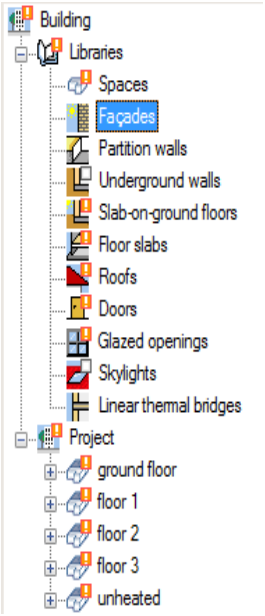


5.10 Technical room

- Select the *Technical room* space type and click on **Edit**.
- Classify the space as *Non-habitable*.
- Type in the data according to the figure below.



6 Defining construction elements

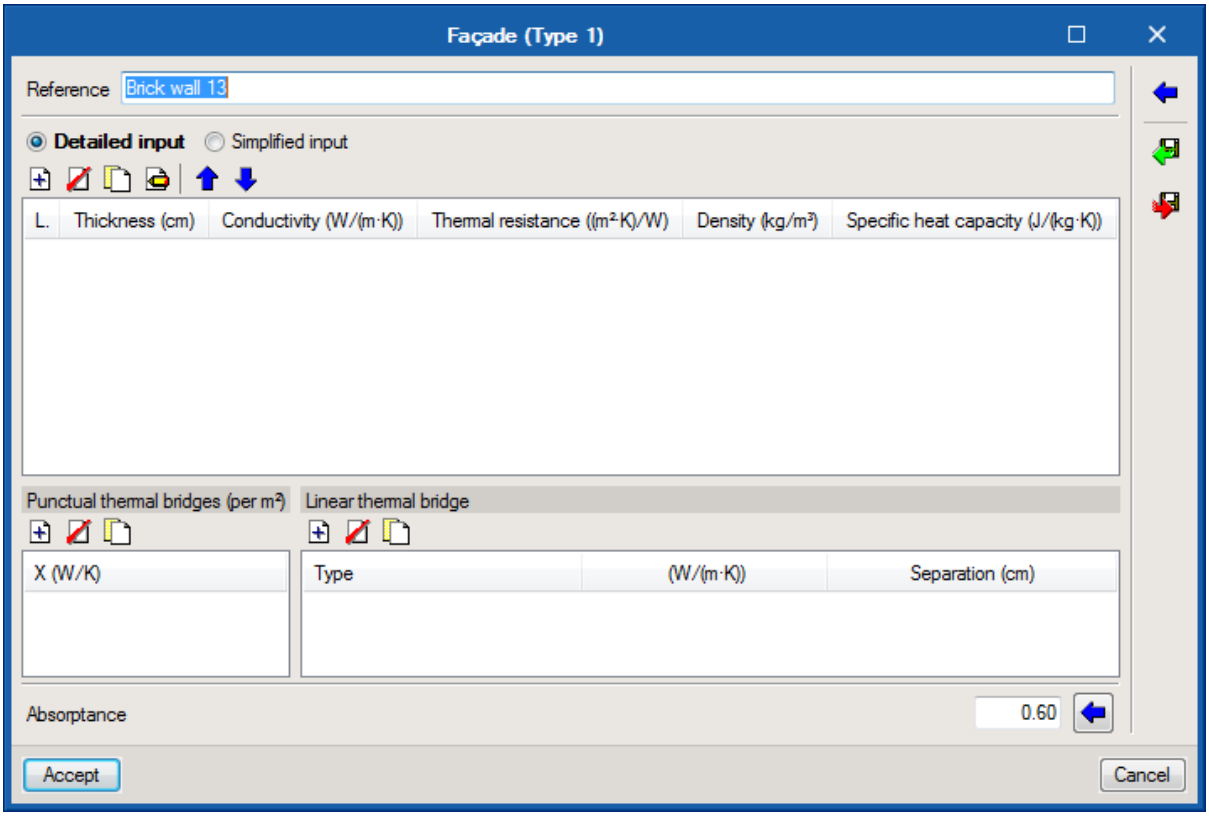


6.1 Façades

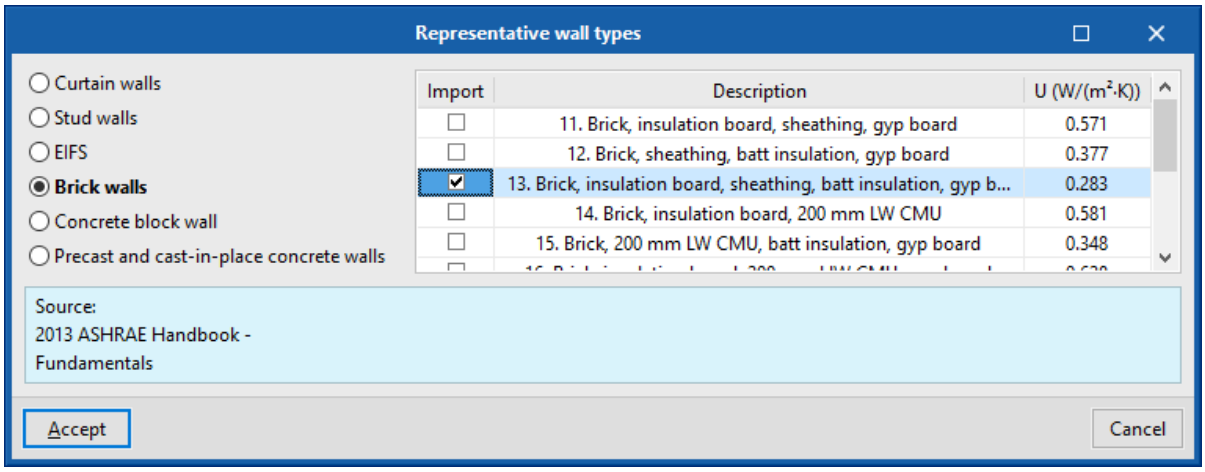
Click on **Façades**.

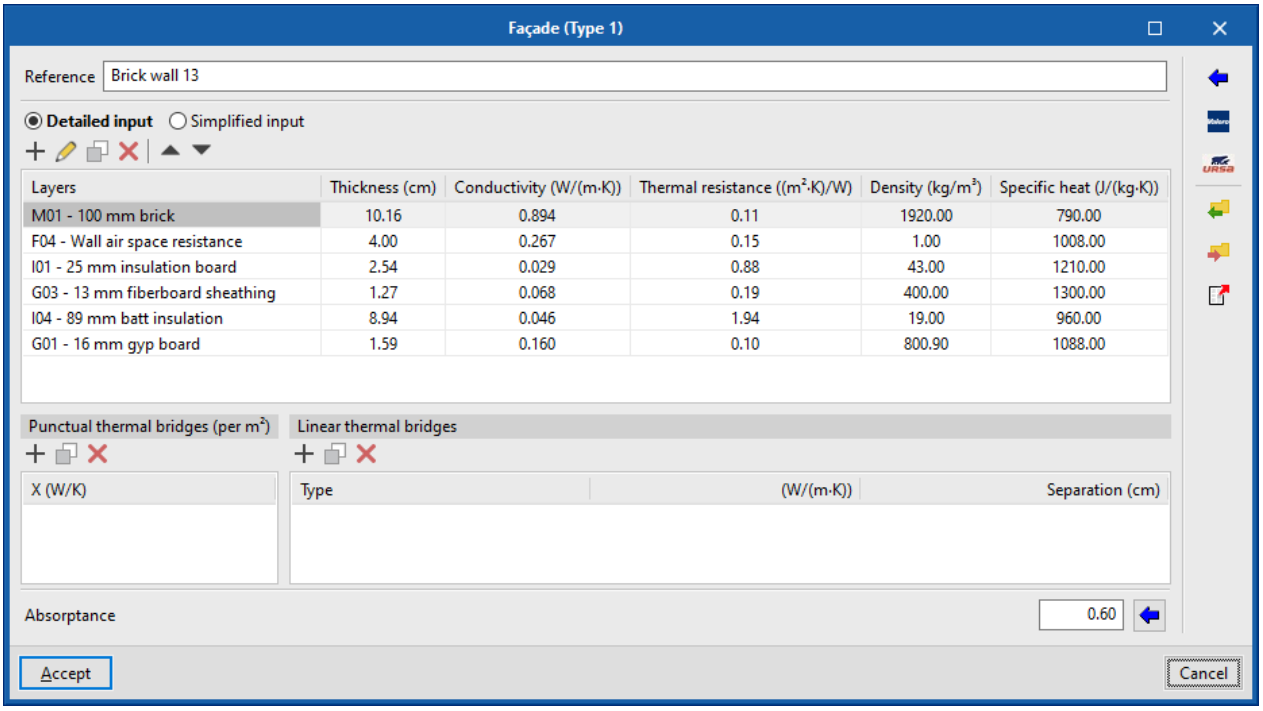
6.1.1 Brick wall 13

- Double-click on it or, with the *Brick wall 13* type selected, click on  **Edit**.



- Click on **Representative wall types** and select option **13. Brick, insulation board, sheathing**... from the *Brick walls* group.

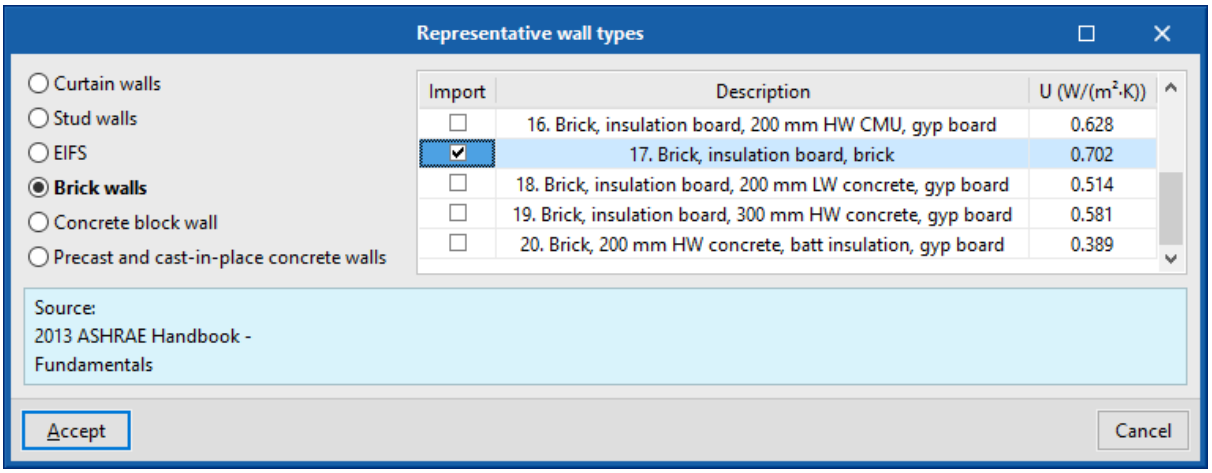


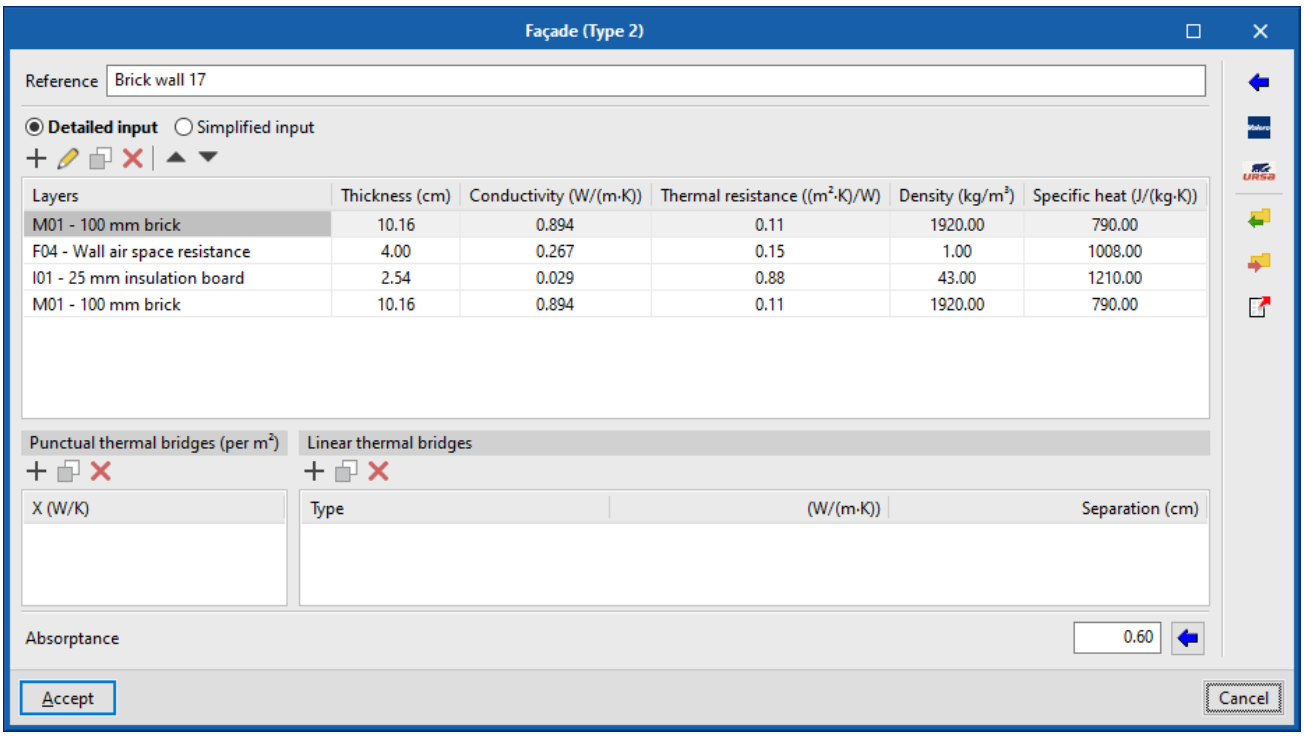


6.1.2 *Brick wall 17*

Double click on **Brick wall 17** (or select it and click on **Edit**).

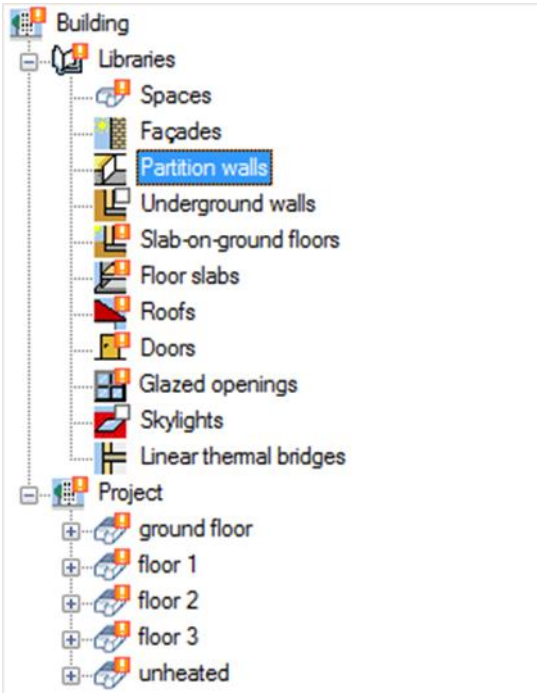
- Click on **Representative wall types** and select option **17. Brick, insulation board, brick** from the *Brick walls* group.





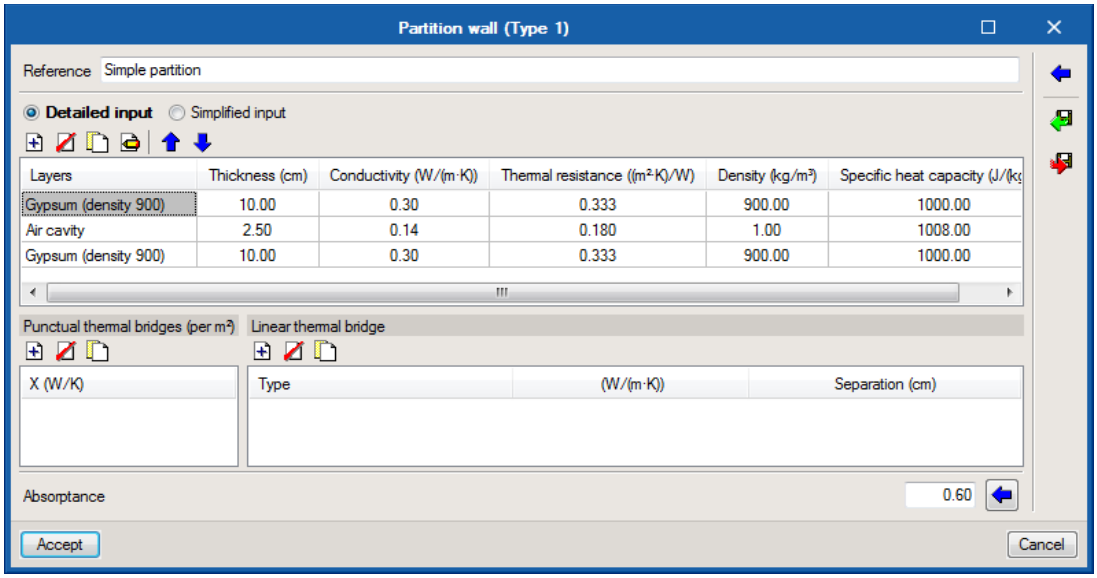
6.2 Partition walls

Next, *Partition walls* will be defined.



6.2.1 *Simple partition*

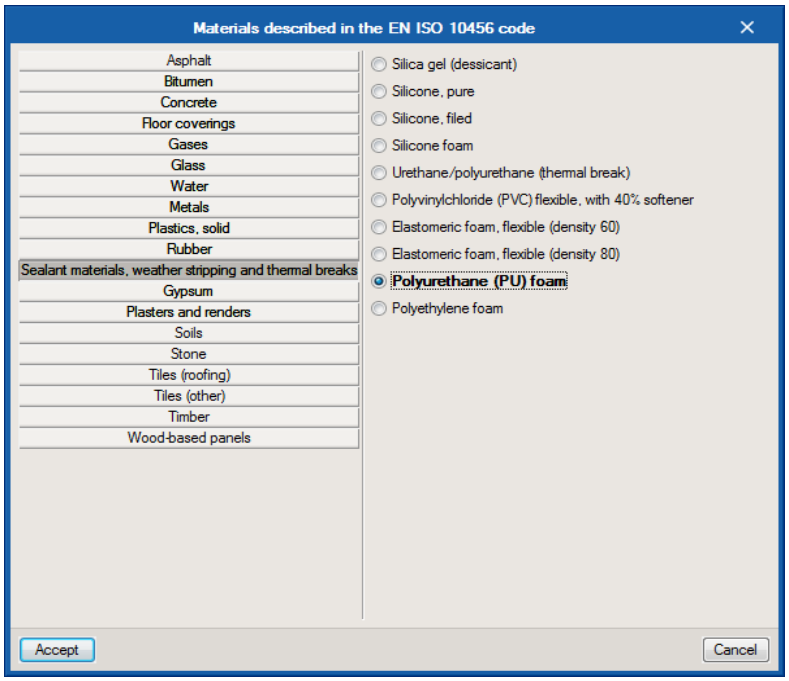
- Double-click on **Simple partition** or click on **Edit**.
- Click on **Add** and then on **EN ISO 10456**. Click on **Gypsum** and select *Gypsum (density 1200)*. Select the white colour.
- Click on **Add** to add a layer of material to the construction system. Click on **Air cavity**, type in 2.5 cm and click on **Accept**.
- With the *Gypsum layer* selected, click on **Copy** to add an identical new layer.



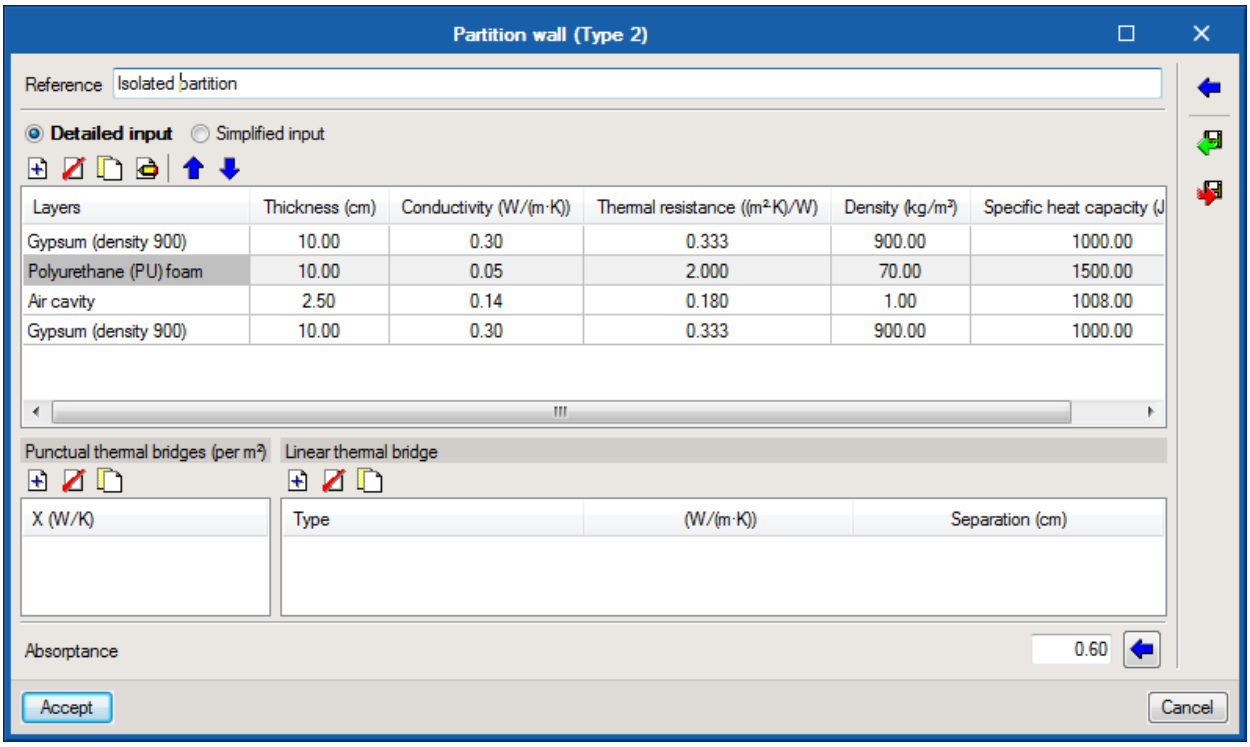
- Click on **Export** to import to other walls and jobs later on.

6.2.2 *Isolated partition*

- Click on **Import**, select *Simple partition* and click on **Accept**. Change the name to "Isolated partition".
- Click on **Add** and then on **EN ISO 10456**. Click on **Sealant materials** and select *Polyurethane (PU)***.** Click on **Accept**. Select the yellow colour.



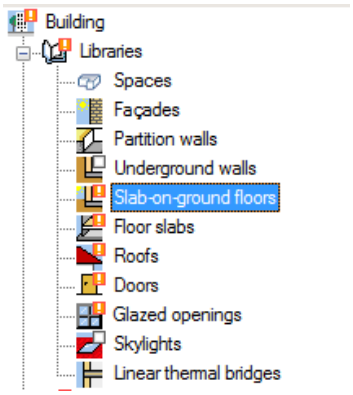
- Move it with the arrow until it is in second place.



- Click on **Export** to import to other walls and jobs later on.

6.3 Slab-on-ground floors

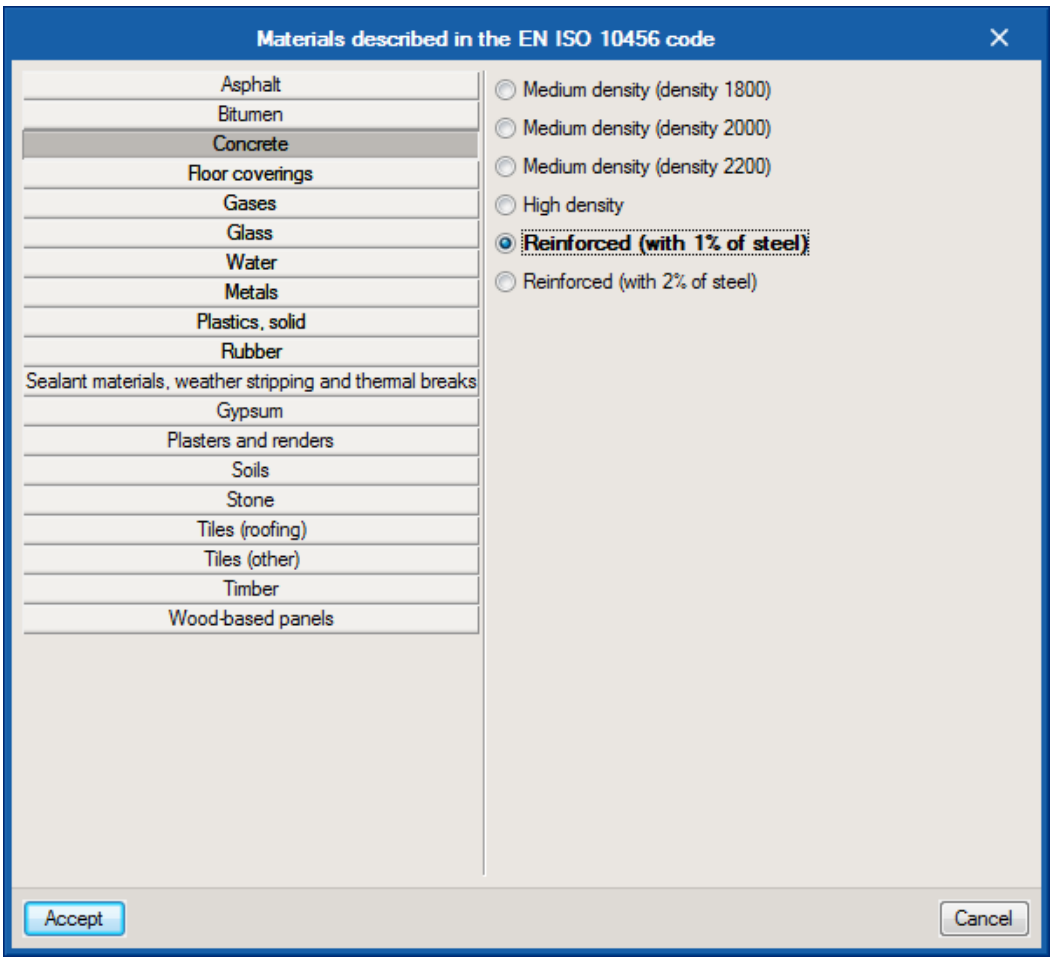
- Click on **Slab-on-ground floors**.



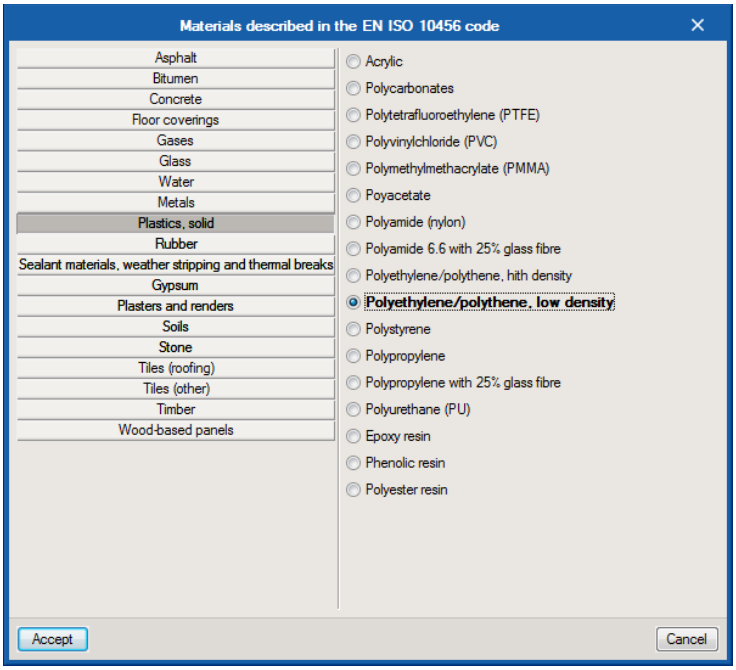
6.3.1 *Screed*

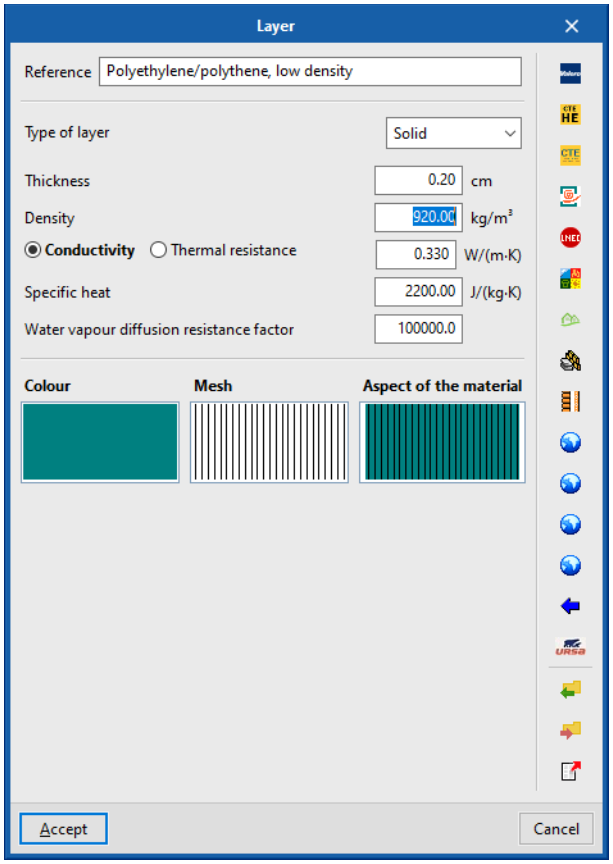
Double-click on **Screed**.

- Click on **Add** and then on the **EN ISO 10456 material**. Click on **Concrete** and then select *Reinforced (with 1% of steel)*. Type in *20 cm*.



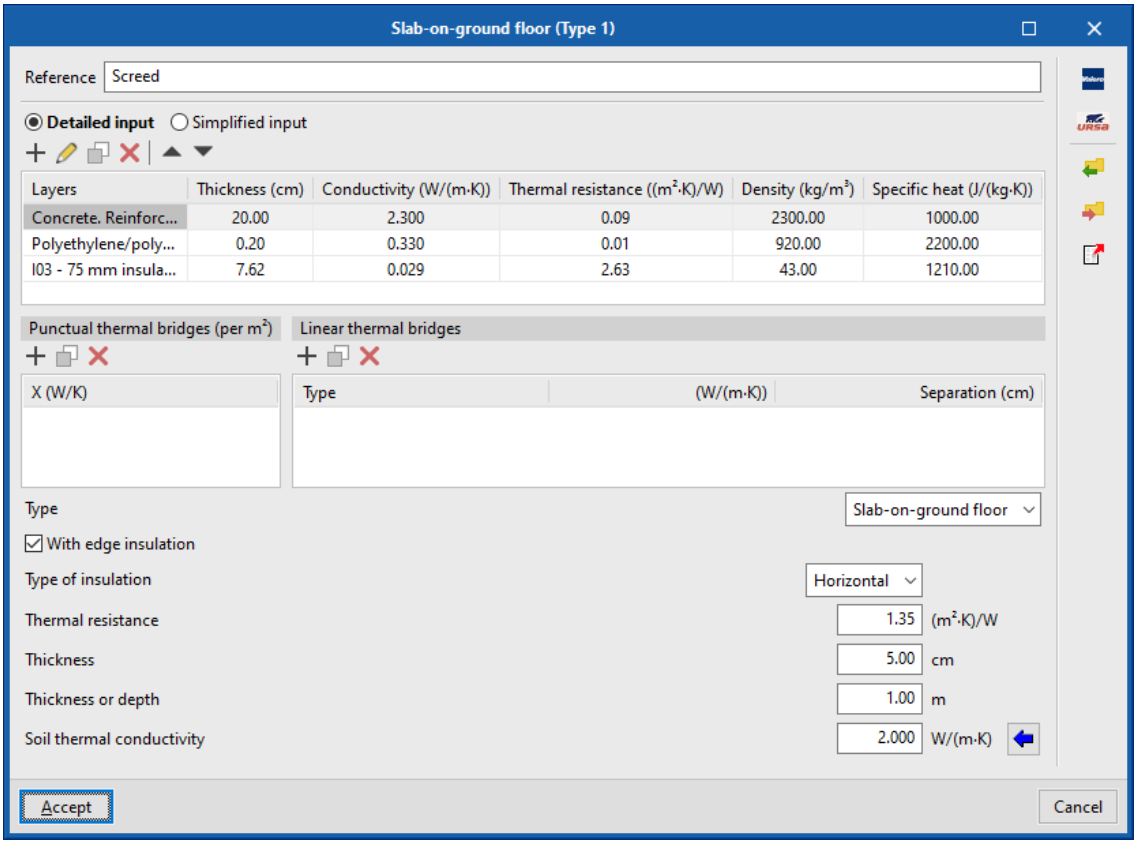
- Click on **Add** and then on the **EN ISO 10456** material. Click on **Plastics, solid** and select *Polyethylene/polythene, low density*. Set the *Thickness* to *0.2 cm*. Click **Accept**.





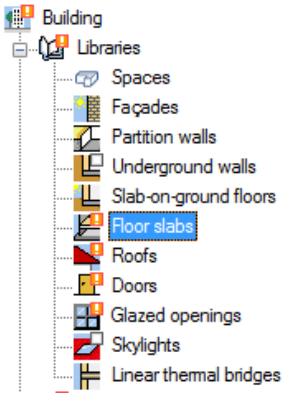
- Click on **Add** and then on **Representative materials**. Click on **Insulating** and select *I03 – 75 mm insulation board*.

- Activate the **with edge insulation** option. Select *Horizontal* as the *Type of insulation*. Type in *1.35 m²K/W* for *Thermal resistance*. Type in *1.0 m* for *Thickness or depth*.



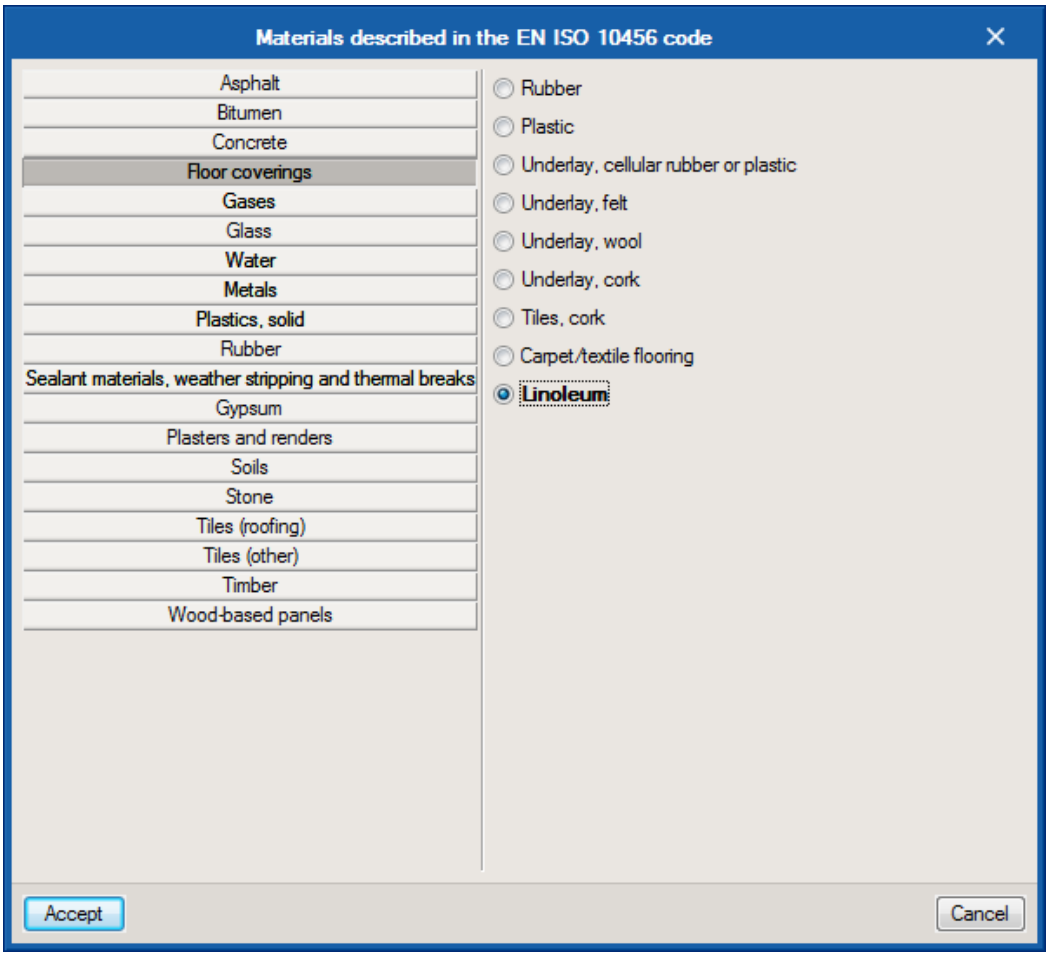
6.4 Floor slabs

Click on *Floor slabs*.



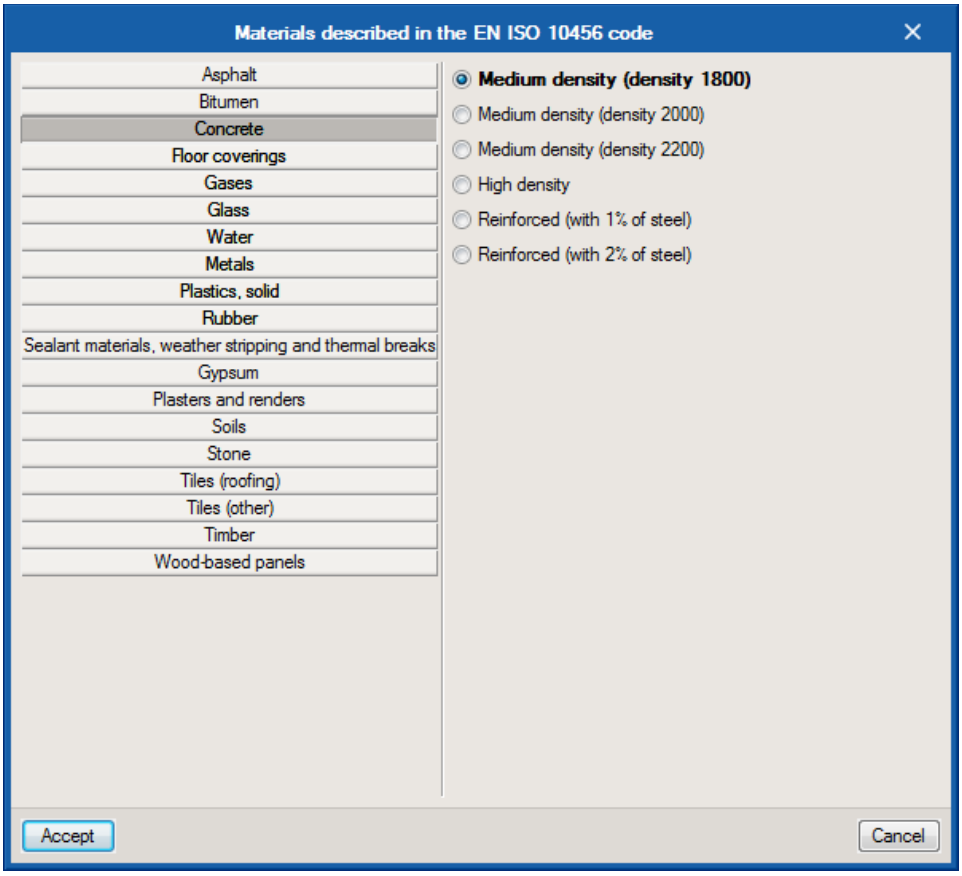
6.4.1 *Floor slab*

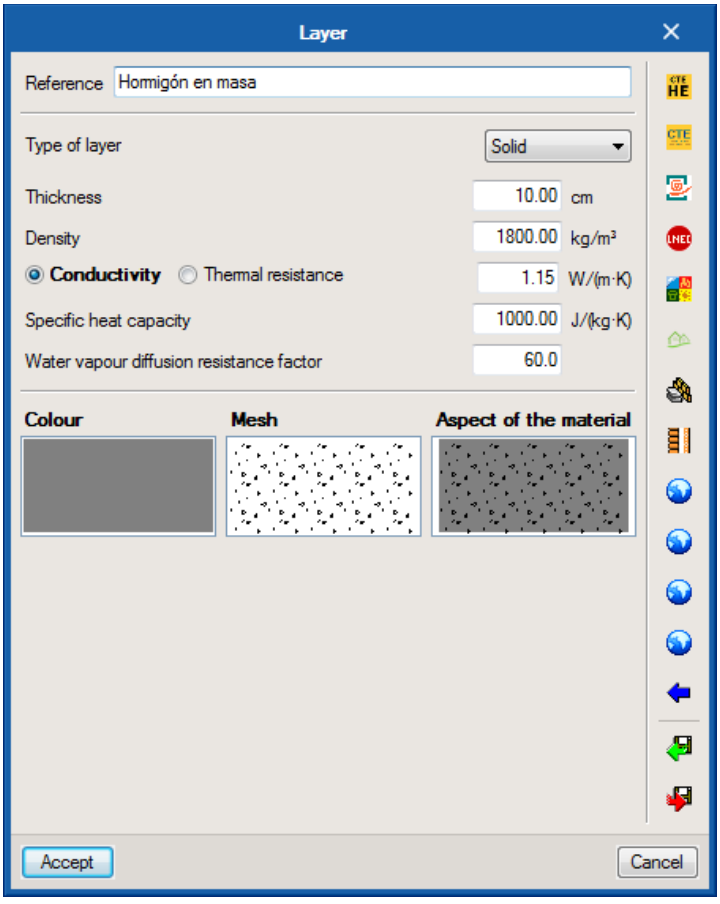
- Click on **Add** and then on the **EN ISO 10456** material. Click on **Floor coverings** and **Linoleum**. Set the *Thickness* to *0.2 cm*.



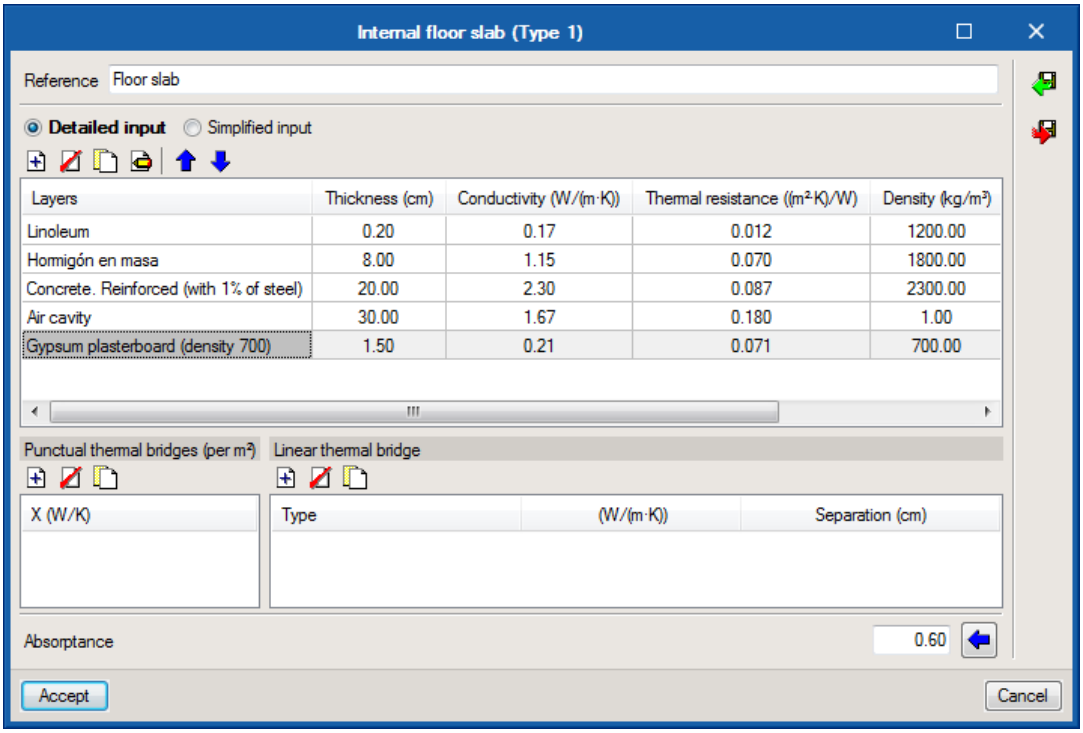
- Click on **Add** and then on the **EN ISO 10456** material. Click on **Concrete, Medium density 1800)**. Set the *Thickness* to *8.0 cm*, change the *Colour* and *Mesh* according to the figures below.

- Click on **Export**, type in the *File* name *"Mass concrete"*.


Materials described in the EN ISO 10456 code
Asphalt
Bitumen
Concrete
Floor coverings
Gases
Glass
Water
Metals
Plastics, solid
Rubber
Sealant materials, weather stripping and thermal breaks
Gypsum
Plasters and renders
Soils
Stone
Tiles (roofing)
Tiles (other)
Timber
Wood-based panels
Medium density (density 1800)
Medium density (density 2000)
Medium density (density 2200)
High density
Reinforced (with 1% of steel)
Reinforced (with 2% of steel)
Accept
Cancel


Layer
Reference
Hormigón en masa
Type of layer
Solid
Thickness
10.00
cm
Density
1800.00
kg/m³
Conductivity
Thermal resistance
1.15
W/(m·K)
Specific heat capacity
1000.00
J/(kg·K)
Water vapour diffusion resistance factor
60.0
Colour
Mesh
Aspect of the material
Accept
Cancel

- Click on **Add** and then on the **EN ISO 10456** materials. Click on **Concrete, Reinforced (with 1% of steel)**. Set the *Thickness* to *20 cm*.
- Click on **Add** and then on **Air cavity,** change the *Air cavity* to *Not ventilated* and the *Layout* to *Vertical* and set the *Thickness* to *30 cm*.
- Click on **Add** and then on the **EN ISO 10456** materials. Click on **Gypsum, Gypsum plasterboard (density 700)**. Set the *Thickness* to *1.5 cm*.
- Click on **Export** to import to other spaces and jobs later on.

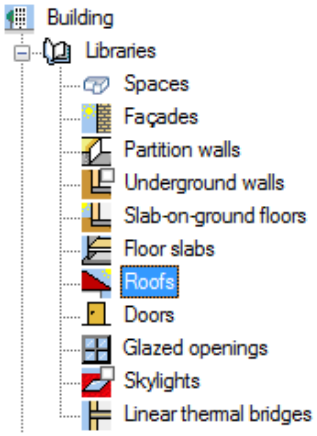


6.4.2 *External floor slab*

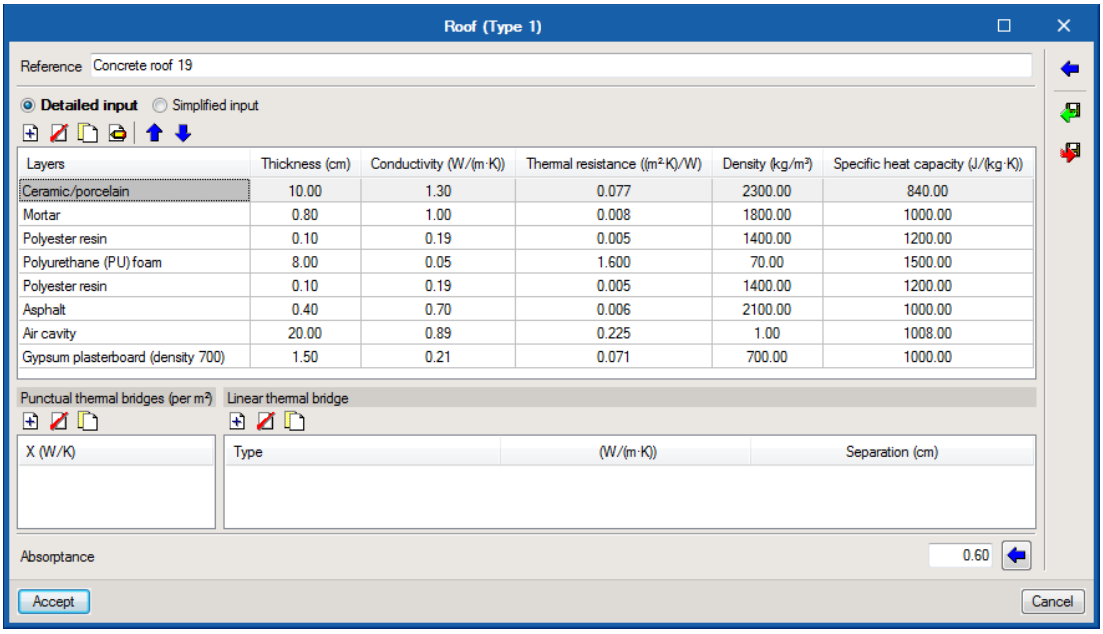
- Click on **Import**, select *Floor slab* and click on **Accept**. Change the name to *"External floor slab"*.
- Delete the gypsum and air cavity layers.

6.5 Roofs

Click on *Roofs*.

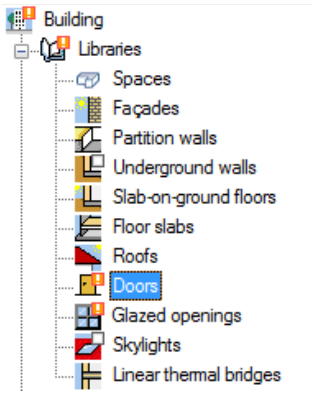


- Click on **Add** and then on **EN ISO 10456**. Click on **Tiles (other)** and **Ceramic**. *Type 1 cm* into *Thickness*.
- Click on **Add** and **Import**, select *Mortar*.
- Click on **Add** and then on **EN ISO 10456**. Click on **Plastics, solids,** and **Polyester resin**, *0.10cm Thickness*, green *Colour*.
- Click on **Add** and then on **EN ISO 10456**. Click on **Sealant materials, weather stripping and thermal breaks** and **Polyethylene foam.** *8 cm Thickness*, yellow *Colour*.
- With the *Polyester resin* layer selected, click on **Copy** to add an identical new layer.
- Click on **Add** and then on **EN ISO 10456**. Click on **Asphalt**, *0.40cm Thickness*, black *Colour*.
- Click on **Add** and then on **Air cavity,** change the *Air cavity* to *Not ventilated* and the *Layout* to *Vertical* and set the *Thickness* to *30 cm*.
- Click on **Add** and then on the **EN ISO 10456** materials. Click on **Gypsum, Gypsum plasterboard (density 700)**. Set the *Thickness* to *1.5 cm*.

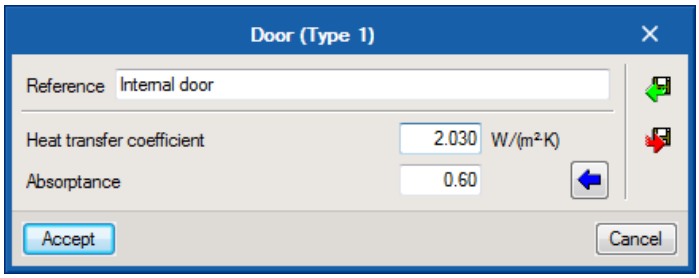


6.6 Doors

Click on *Doors*.

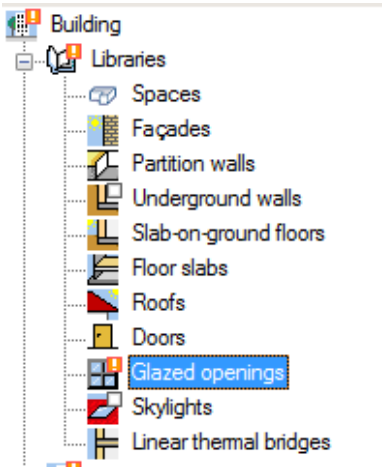


- There are two door types to be defined.
- Double click or click on edit with the door selected, and type *2.030* into the *Heat transfer coefficient*, for each one of them.

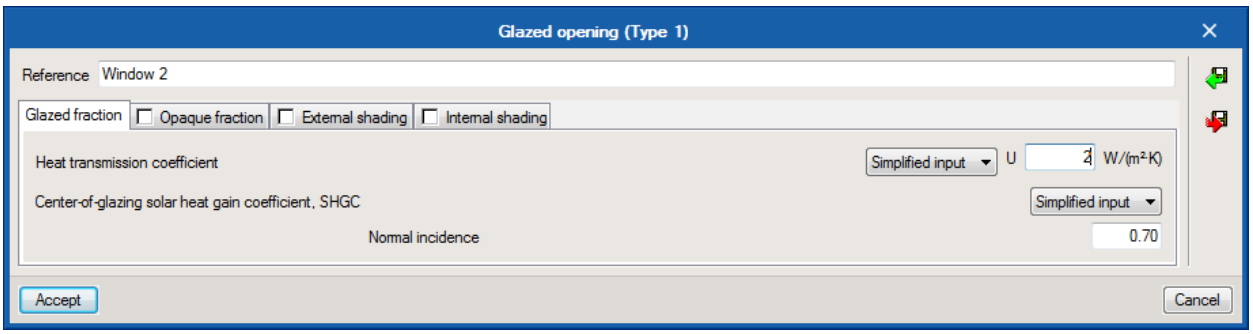


6.7 Glazed openings

Click on *Glazed openings*.

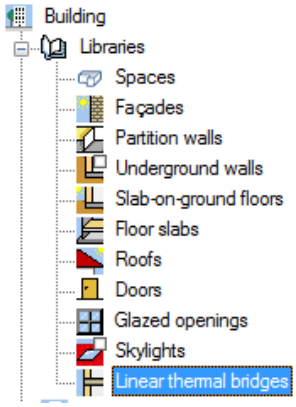


- Double click or click on **Edit** for each one of them, and type *2* into the *Heat transfer coefficient*, in each of them.

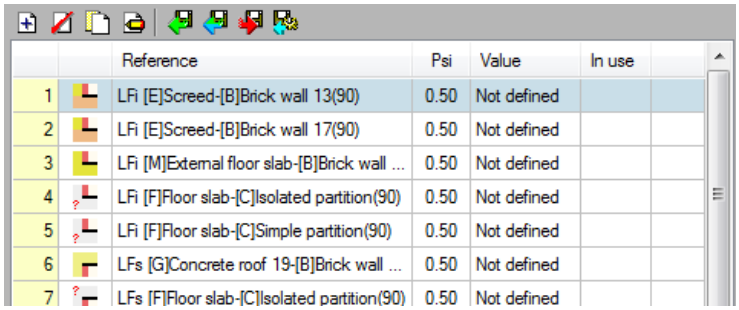


6.8 Linear thermal bridges

Click on **Linear thermal bridges**.

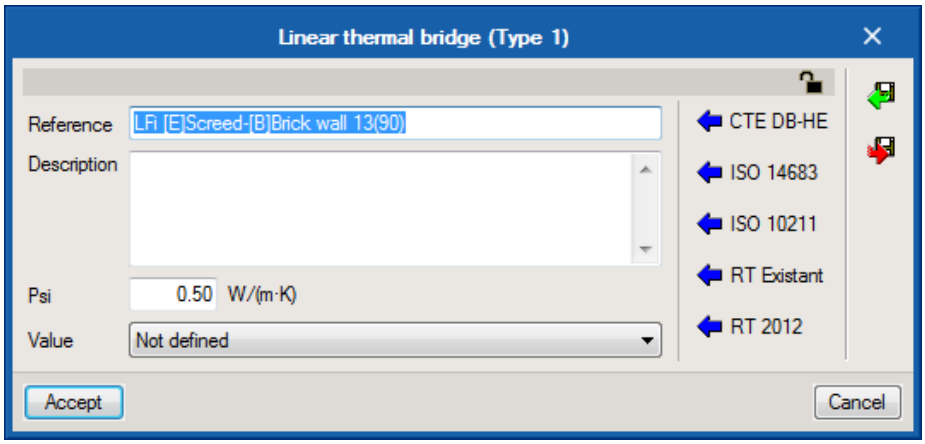


All detected *Edges* with a default value of *0.5* in the *Psi* are displayed, and their values can be confirmed or changed by the user.



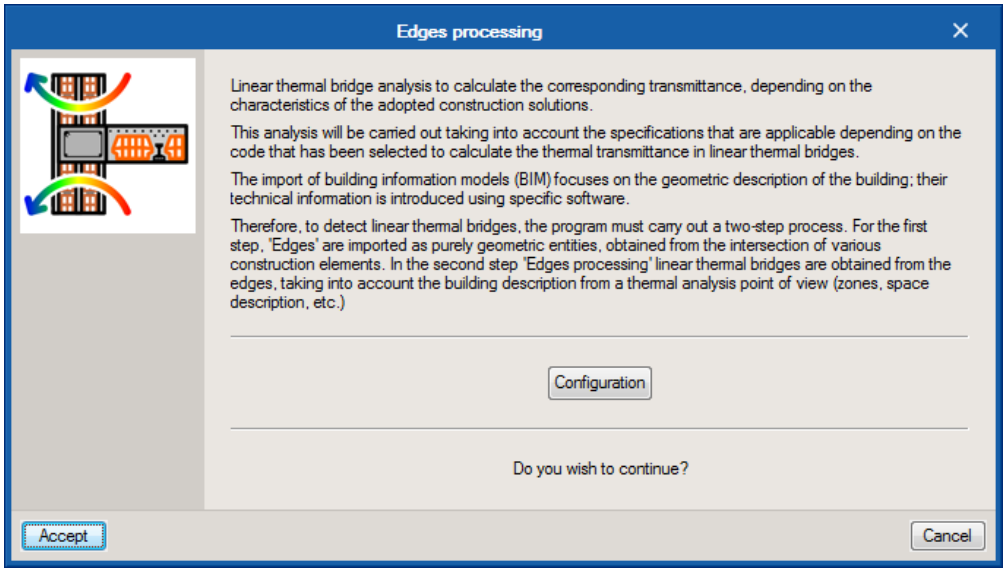
		Reference	Psi	Value	In use
1		LFi [E]Screed-[B]Brick wall 13(90)	0.50	Not defined	
2		LFi [E]Screed-[B]Brick wall 17(90)	0.50	Not defined	
3		LFi [M]External floor slab-[B]Brick wall ...	0.50	Not defined	
4		LFi [F]Floor slab-[C]Isolated partition(90)	0.50	Not defined	
5		LFi [F]Floor slab-[C]Simple partition(90)	0.50	Not defined	
6		LFs [G]Concrete roof 19-[B]Brick wall ...	0.50	Not defined	
7		LFs [F]Floor slab-[C]Isolated partition(90)	0.50	Not defined	

The definition of a linear thermal bridge can be manual or automatic. A manual definition can be carried out by editing the linear thermal bridge and filling in the corresponding heat transfer coefficient; there are predefined libraries for importing values.

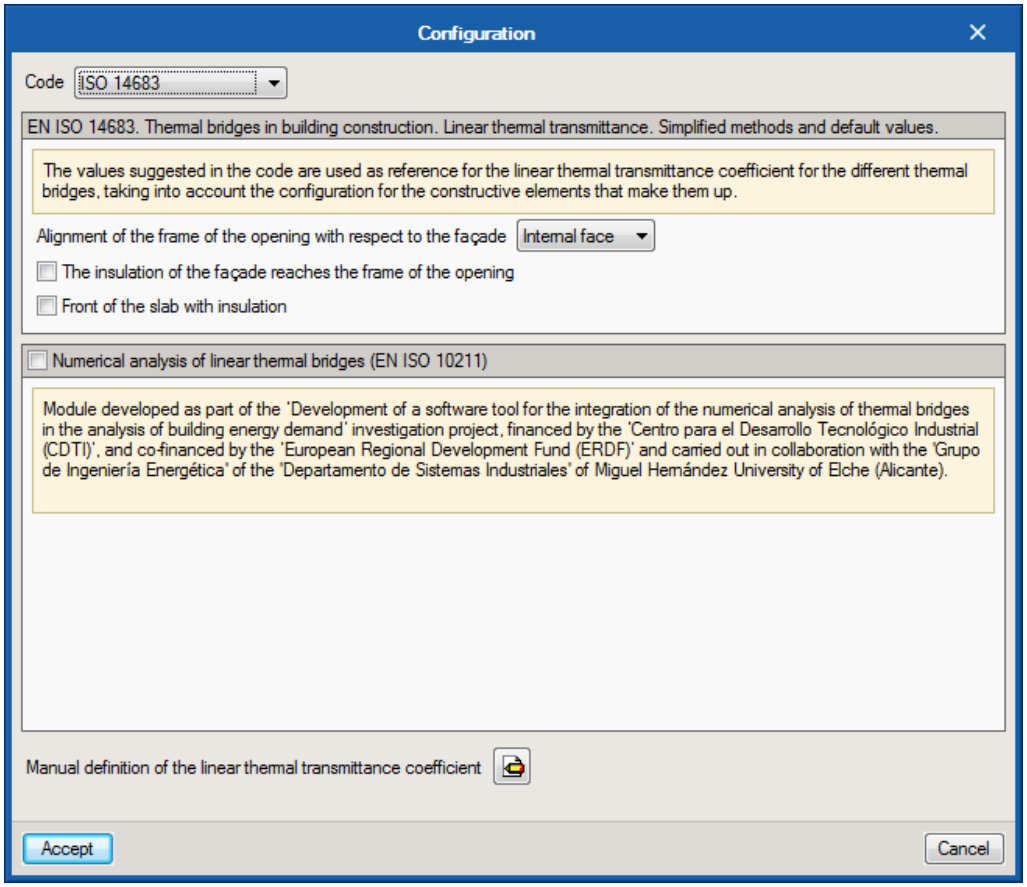


Automatic configuration is described as follows.

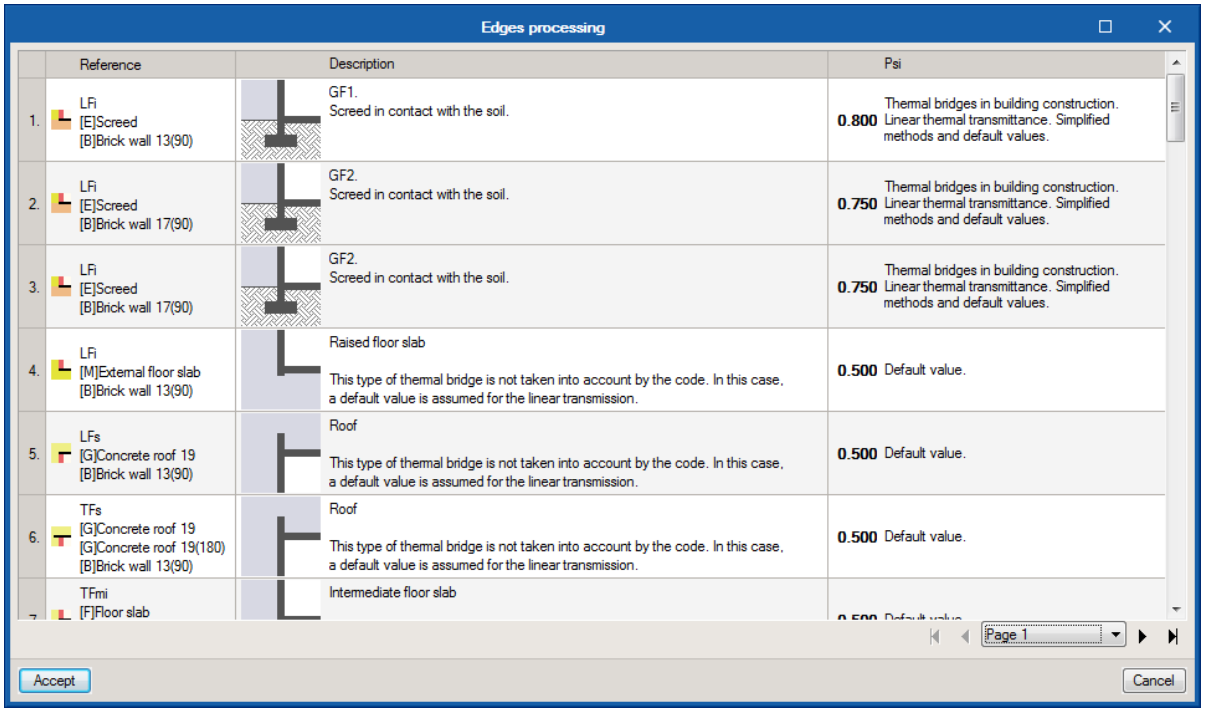
- In the (wider) ribbon toolbar, click on the **Edges** icon.



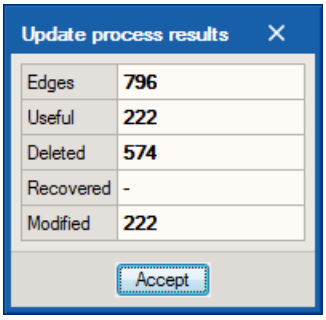
- Click on **Configuration** and fill in the data according to the figure below. Click **Accept**.



The *Edges processing* window appears with the calculation of the *Psi*.



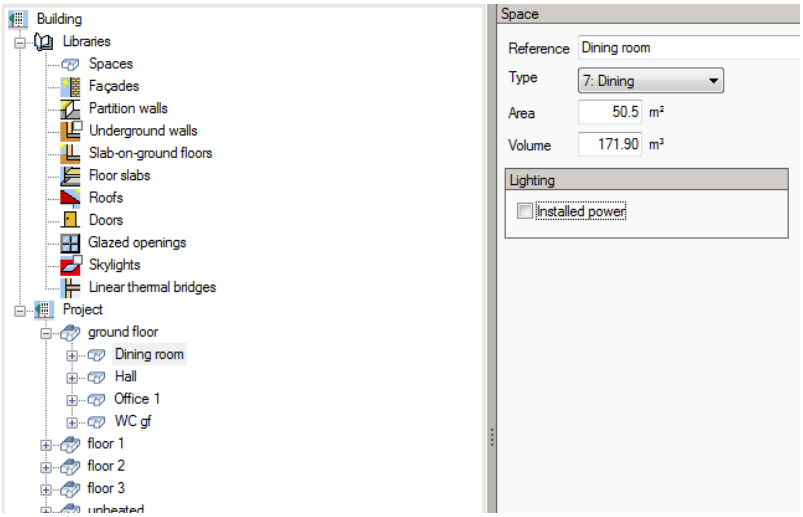
- Once we accept, the *Update process results* window appears.



In the structure, in *Project*, the spaces are grouped together. Inside each space, their construction elements and linear thermal bridges can be found.

When selecting a space, the *Installed power* of the *Lighting* for that specific space can be defined. When the programme carries out the thermal load calculation, it will use this value, ignoring the one entered in the space type.

This value can be entered either manually or by importing a BIM lighting model.

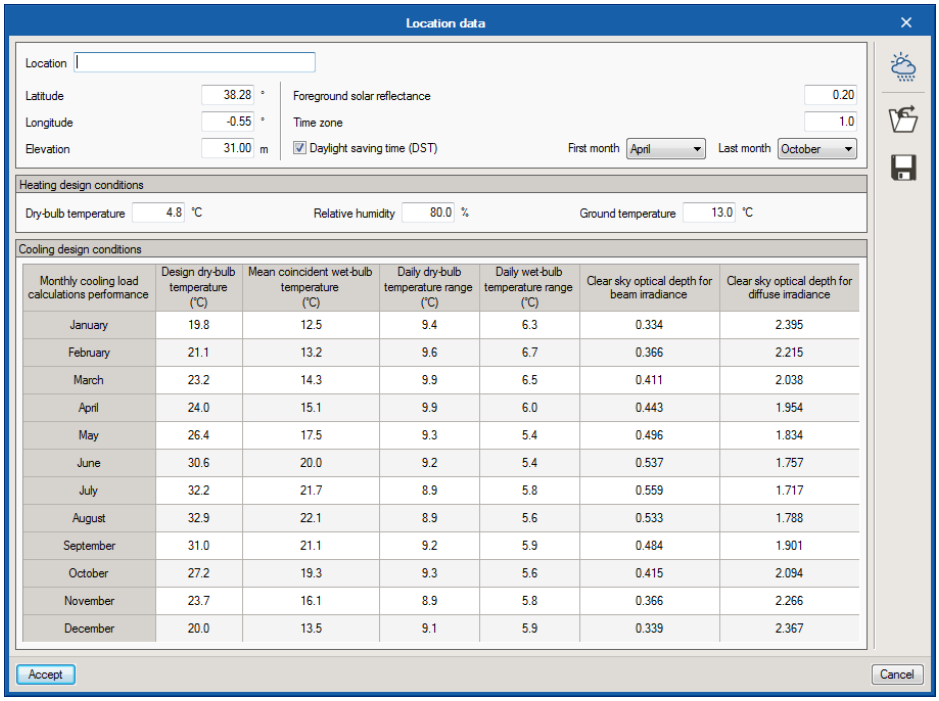


7 Defining the Calculation model

Click on the *Thermal loads* tab.

7.1 Location data

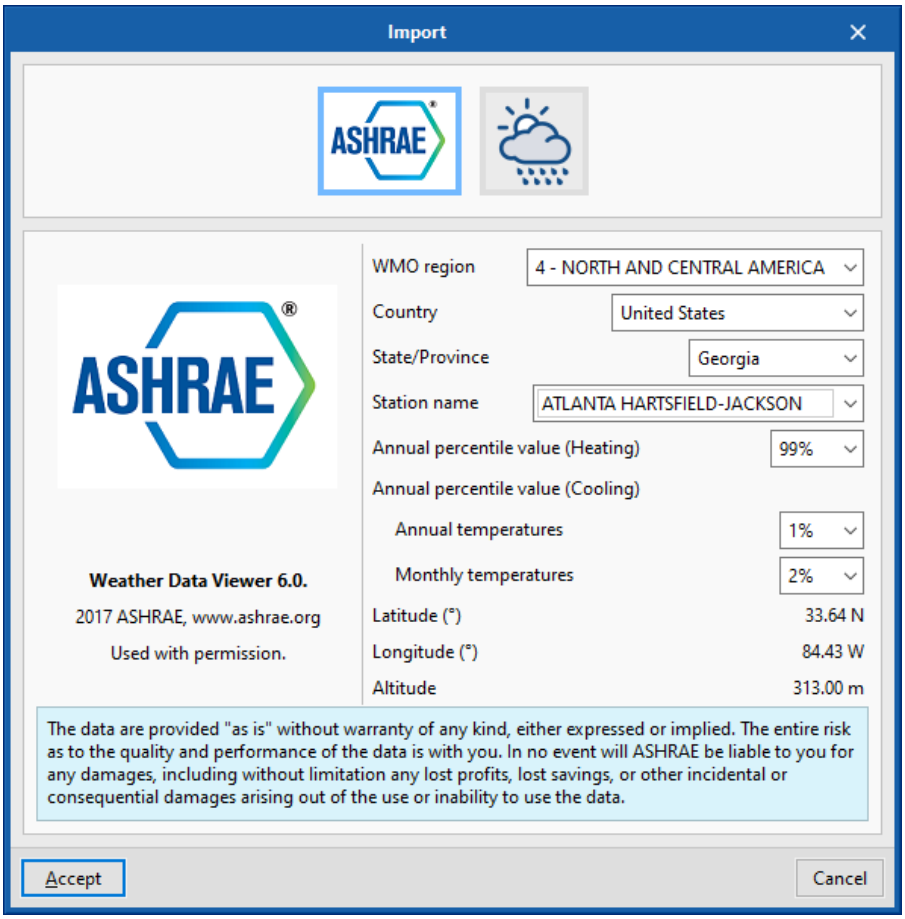
- Click on **Location data**. The configuration window for *Location data* and the heating and cooling *Design conditions* will appear.



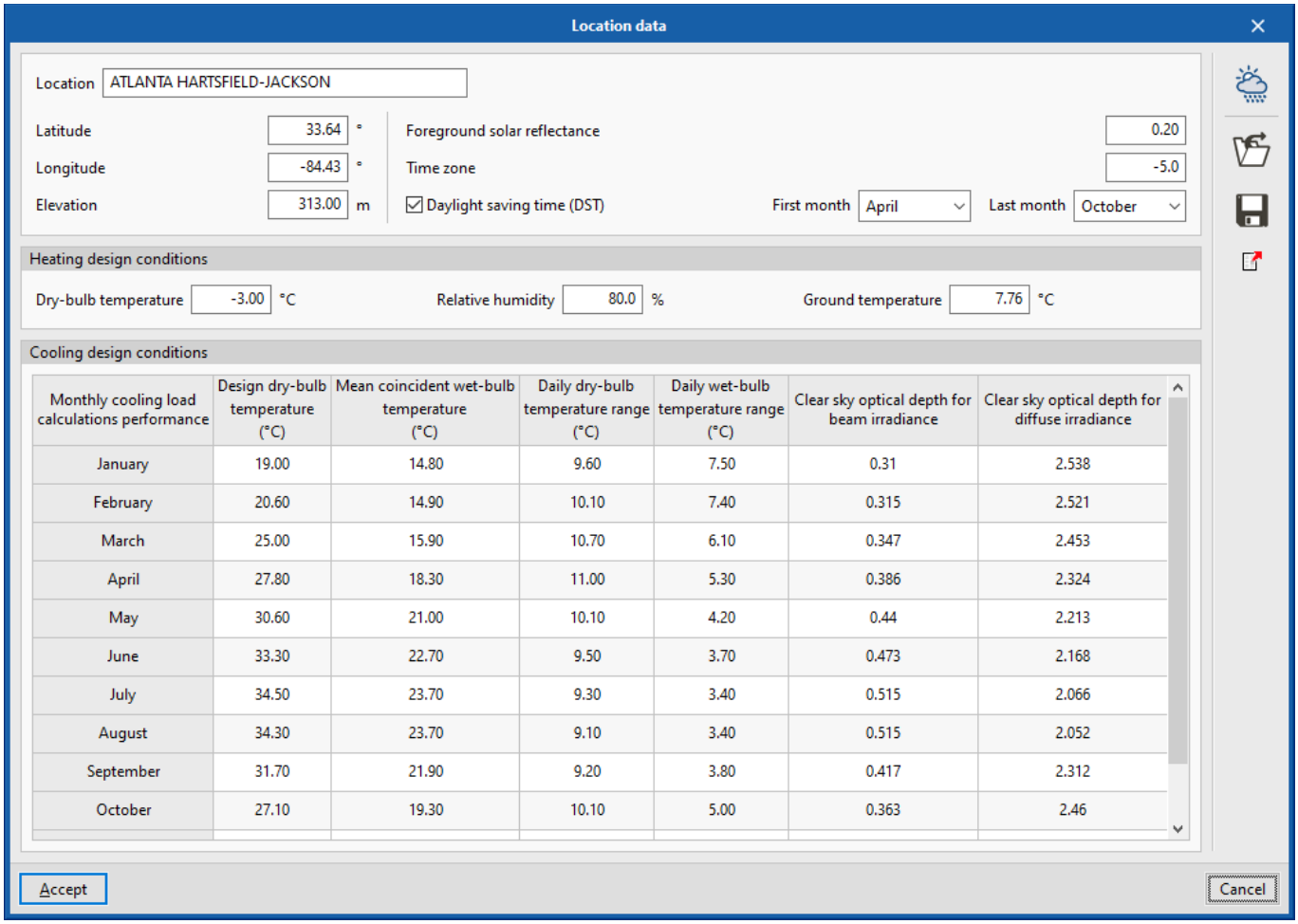
Monthly cooling load calculations performance	Design dry-bulb temperature (°C)	Mean coincident wet-bulb temperature (°C)	Daily dry-bulb temperature range (°C)	Daily wet-bulb temperature range (°C)	Clear sky optical depth for beam irradiance	Clear sky optical depth for diffuse irradiance
January	19.8	12.5	9.4	6.3	0.334	2.395
February	21.1	13.2	9.6	6.7	0.366	2.215
March	23.2	14.3	9.9	6.5	0.411	2.038
April	24.0	15.1	9.9	6.0	0.443	1.954
May	26.4	17.5	9.3	5.4	0.496	1.834
June	30.6	20.0	9.2	5.4	0.537	1.757
July	32.2	21.7	8.9	5.8	0.559	1.717
August	32.9	22.1	8.9	5.6	0.533	1.788
September	31.0	21.1	9.2	5.9	0.484	1.901
October	27.2	19.3	9.3	5.6	0.415	2.094
November	23.7	16.1	8.9	5.8	0.366	2.266
December	20.0	13.5	9.1	5.9	0.339	2.367

Data can be changed manually or saved data can be imported from the library. In this example, the ASHRAE database will be used.

- Click on the **ASHRAE Weather Data Viewer** icon and select the data shown in the figure.

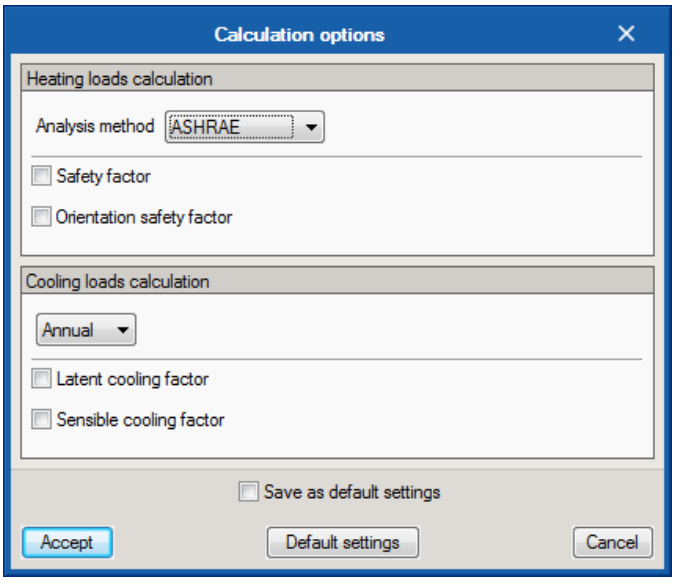


- Click **Accept** to import the selected data.



7.2 Calculation options

- Now, click on **Calculation options**.

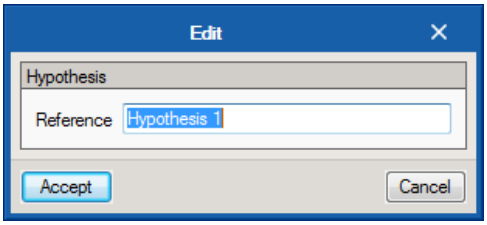


In this dialogue box, the calculation options for calculating thermal loads can be modified. In the calculation for heating thermal loads, the EN 12831 code or ASHRAE standard can be selected. In the cooling thermal load calculation, the programme uses the ASHRAE method.

- Click on **Accept** to keep the default settings. The aim is to define the zones and corresponding spaces.

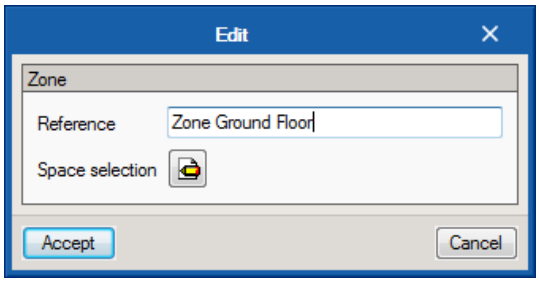
7.3 Hypothesis and Thermal zones

- Click on **Hypothesis**, maintain the *Reference* and click **Accept**.

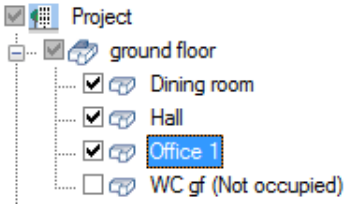


In this example, one zone will be created for the ground floor, and another will be created for the remaining offices.

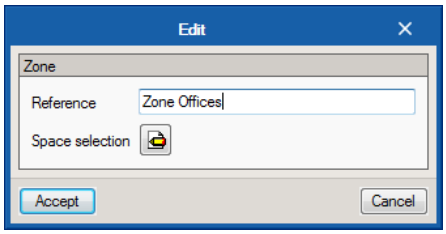
- Click on **Zone**, and type *"Zone Ground Floor"* into the *Reference*.



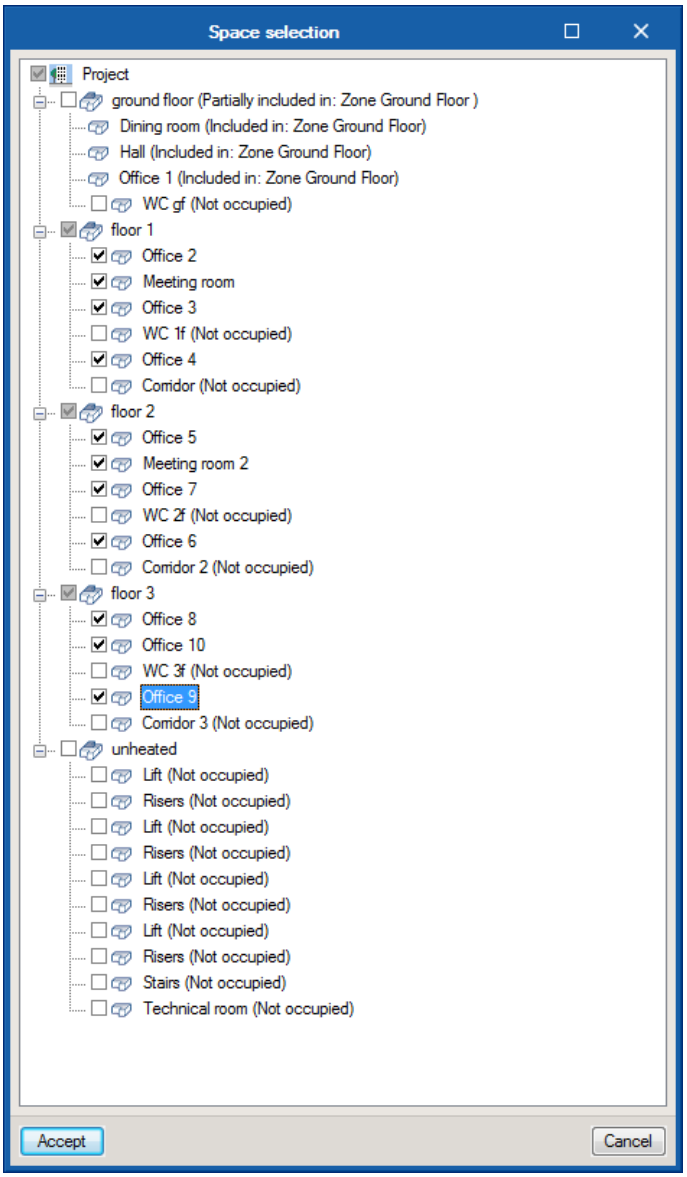
- To select the spaces that will be included in this zone, click on **Space selection,** and select only the spaces that will be air-conditioned on the ground floor.



- The aim here is to create a new zone. Select *Hypothesis 1* from the list. Click on **Zone**. Enter a *Reference* (i.e., *Zone Offices*)**.**



- Click on **Space selection** and mark all the offices and meeting rooms.



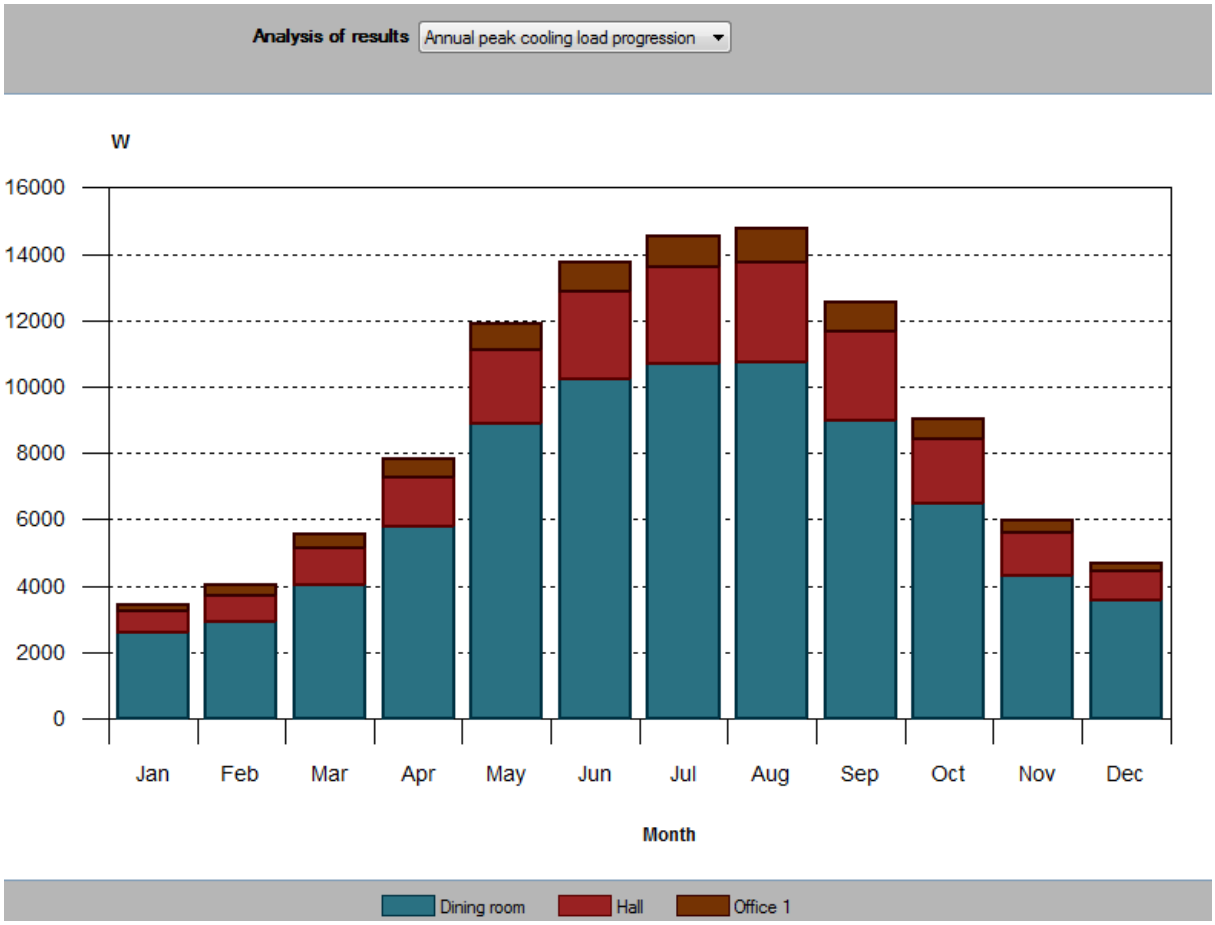
The model of the building has been fully defined.

8 Calculation and analysis of results

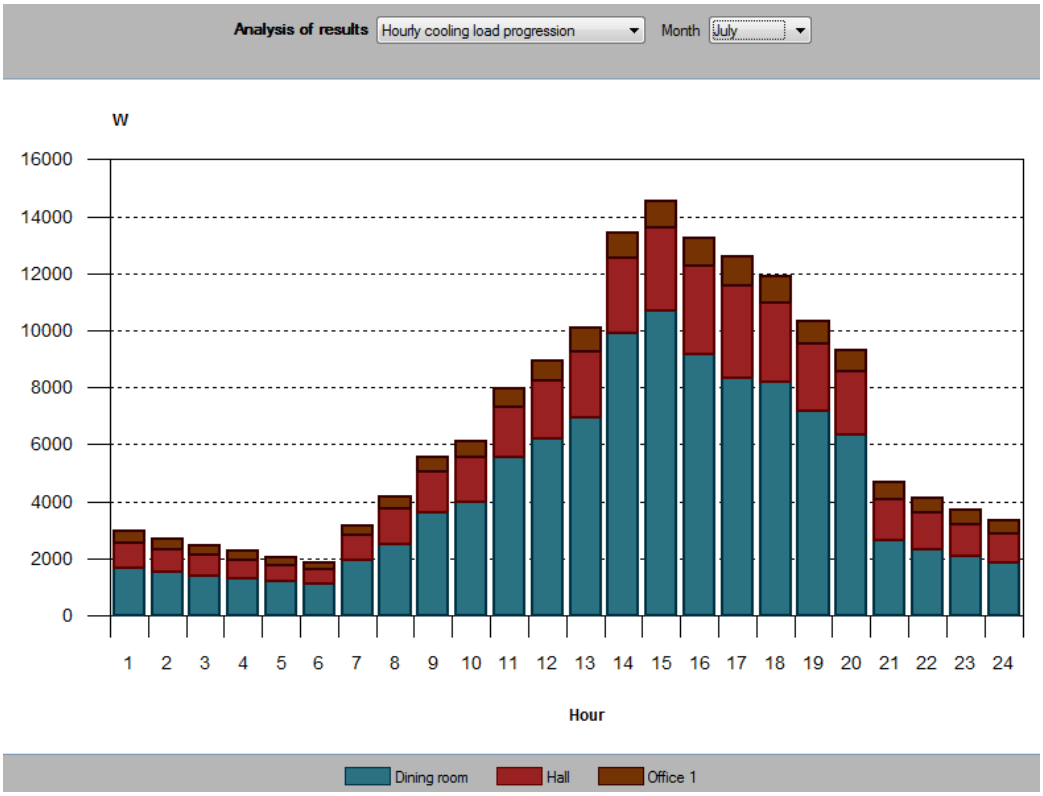
8.1 Update results

To either carry out or update the analysis of results, click on the **Update results** icon. After the calculation, users will be able to analyse the calculated values.

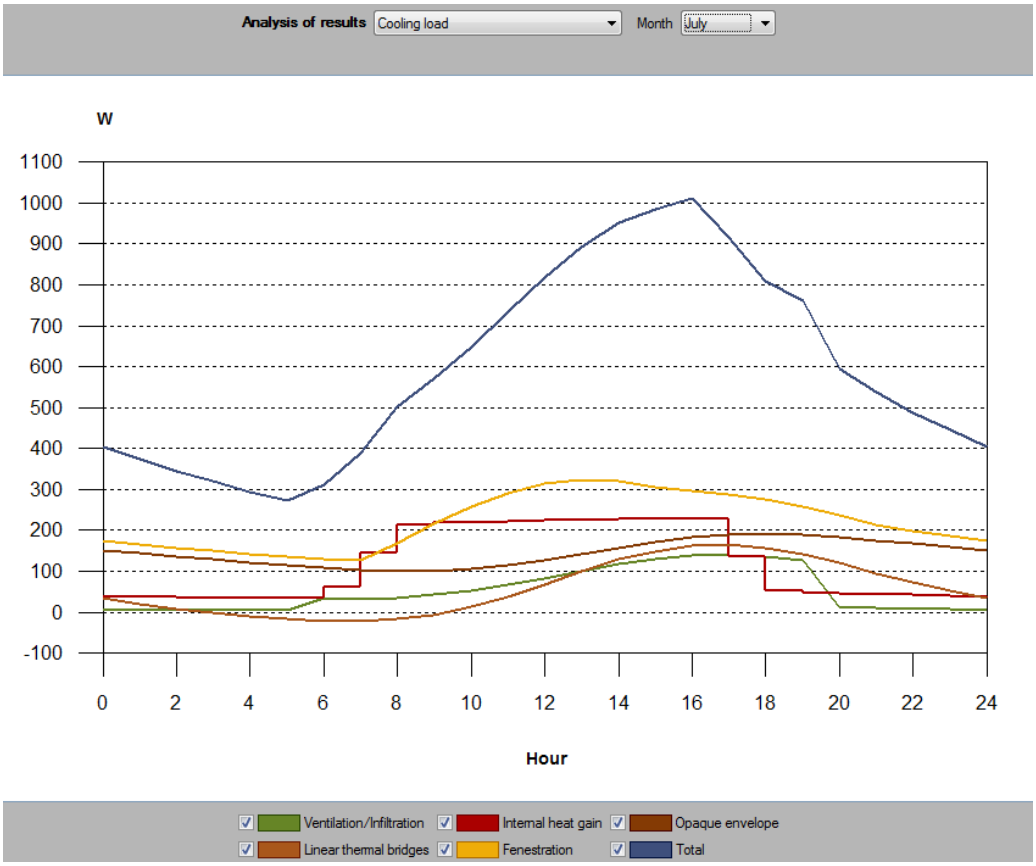
Click on **Ground Floor Zone** in the list to check the *Annual peak cooling load progression*, for example.



Clicking on the **Analysis of results** list, other data can be checked, such as the *Hourly cooling load progression*.

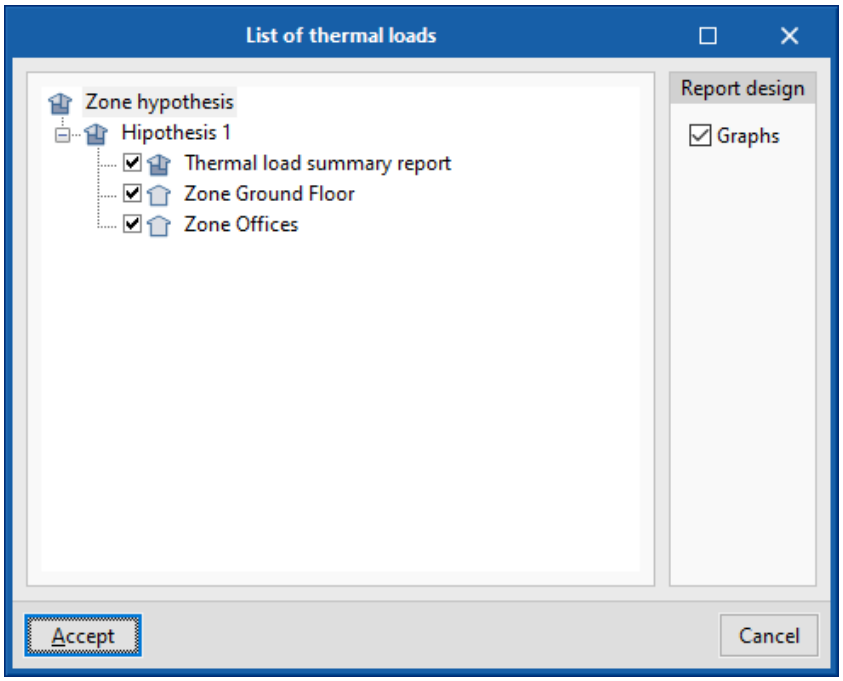


More data can be checked by clicking on the *Office 1* space.



8.2 List of results and complementary reports

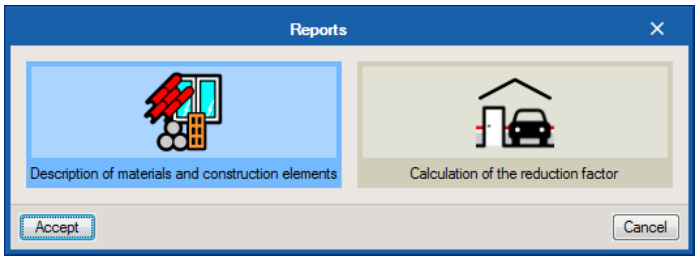
To check the thermal load calculation result, click on **List of thermal loads**. In the pop-up panel, the content of the list can be selected. A summary of the results and the spaces of each zone to be included in the report can be selected as well as the possibility of including *Graphs*:



The complete list of thermal loads for the two zones can also be accessed by selecting *Hypothesis 1* from the list and clicking **Complete report.** If you wish to view only one zone, click on the desired zone and then on **Complete report**.

For each level of the list, the programme includes a report where the methodology used in the implemented calculations is displayed. To view it, select the **Calculation description** option in the *Analysis of results* section.

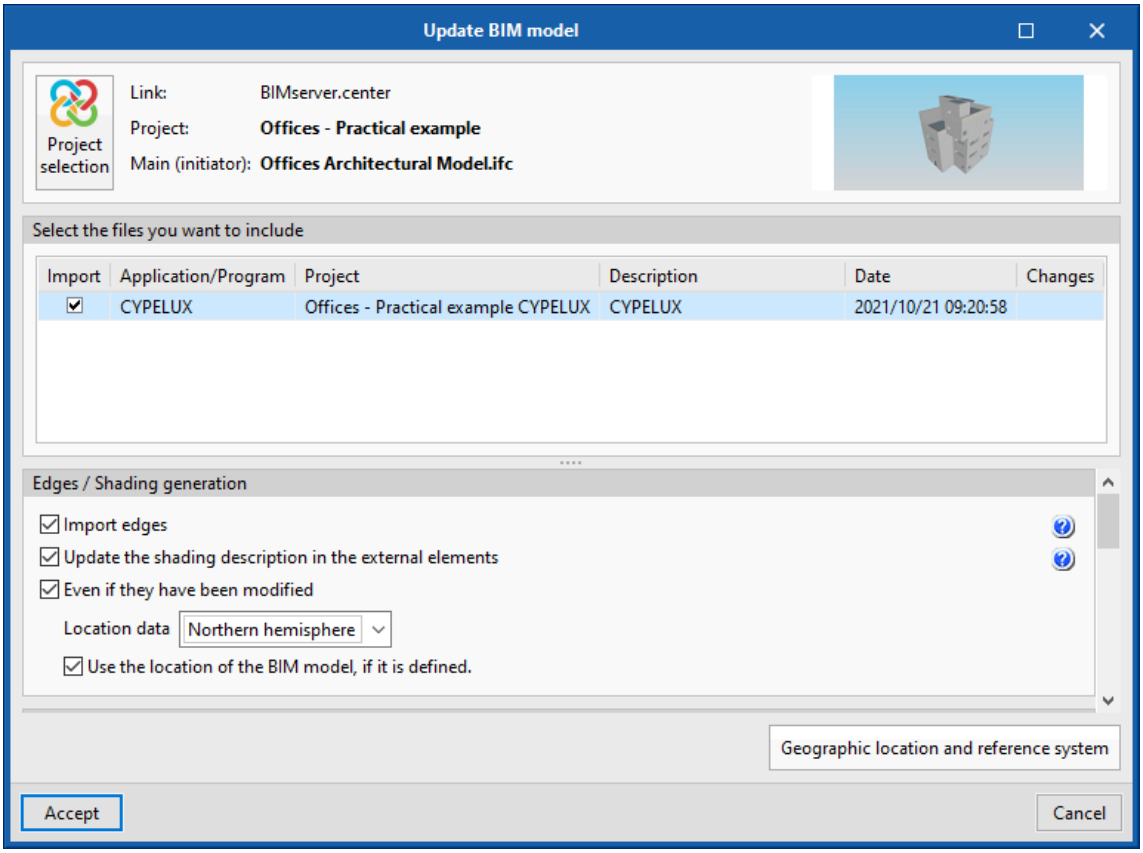
Clicking on the **Additional reports** icon in the top toolbar, the *Description of materials and construction elements* and *Calculation of the reduction factor* documents can be checked.



9 Updating and exporting the BIM model

Any changes in the BIM model of the building can be reflected in the calculation model via the update function. If the programme detects that the BIM model has been modified, the **Update** option will alert users by flashing the following icons .

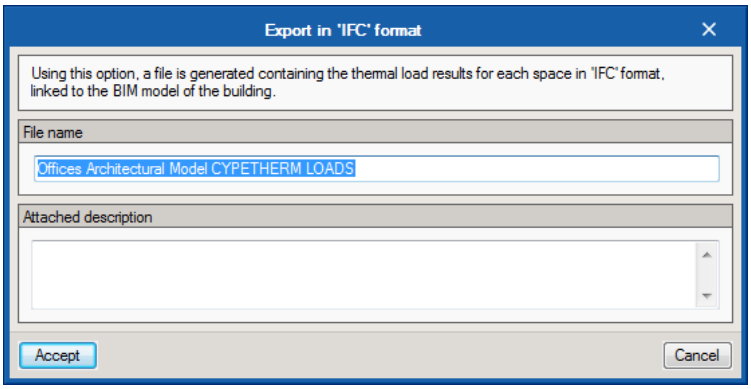
In this case, in order to proceed with the update, click on **Update**.



The programme will indicate whether or not the project has been modified at the top. During the update process, the actions to be carried out for new, modified, or deleted elements can be parameterised. The typologies of construction systems, edges and shading can also be updated via the BIM model update.

For exporting the thermal load values in an IFC file format, in order for them to be imported into the CYPETHERM HVAC programme, for example, or into any other Open BIM programme, the following process must be followed.

Click on the **Share** icon.



This way, an IFC file with the thermal loads of each space in the building is exported to the relevant project in BIMserver.center.

If the project is updated, a new export must be made by updating the information present in the IFC file.

The information generated by CYPETHERM LOADS can be used by other programmes. For example, HVAC design programmes integrated into the Open BIM workflow via the BIMserver.center programme can import the calculated thermal loads for the installation design.